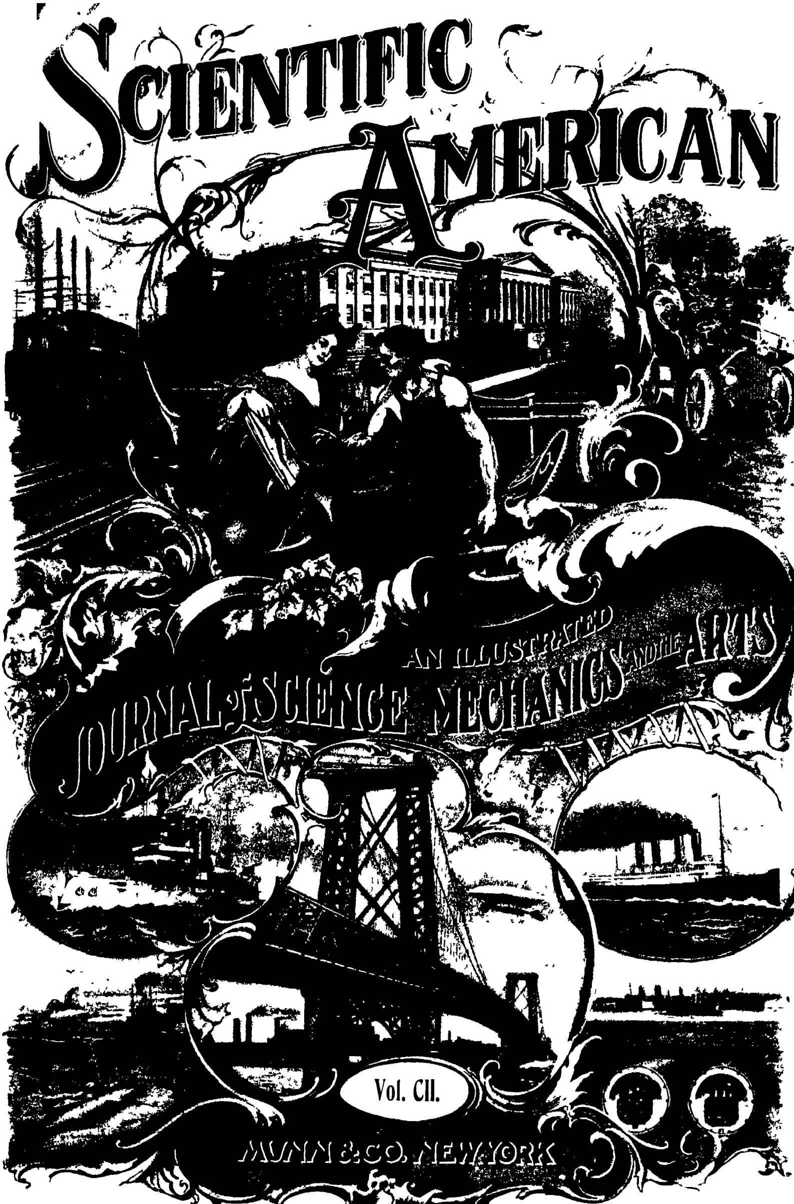
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Dr. Leonard Hill of the London Hospital is conducting a series of experiments to determine how much harder a man can work after inhaling oxygen

INHALING OXYGEN TO INCREASE MUSCULAR ENERGY.—[See page 6.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, JANUARY 1st, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RETROSPECT OF THE YEAR 1909

Exploration

The year 1909 will forever be famous in the annals of scientific accomplishment as having witnessed the successful culmination of the age-long quest for the North Pole, and the achievement of Commander Robert E. Peary of the United States navy in finally reaching this theoretical point at the dome of the world after twenty-three years of practically uninterrupted endeavor, will stand as the most difficult feat of geographical exploration in the history of the world. It was eminently fitting that Peary should be the first to reach the North Pole, for among all the Arctic explorers he was easily the first in practical knowledge and experience. When he announced to the world on September 5th that on April 6th, 1909, he had reached the coveted goal, his word was accepted without question. Subsequently his data was passed upon favorably by the National Geographic Society of America, which later presented him with its medal; and the verdict of this tribunal has been tacitly indorsed by the various learned societies throughout the world.

In our issue of September 11th, commenting upon the freely expressed doubts of Dr. Cook's claim that he also, and a year earlier, had reached the North Pole, we wrote: "The man who can look Death full in the face throughout all the cruel sufferings of a two years' search for the secret of the frozen North is built upon lines too noble to admit of the slightest subterfuge or misrepresentation." It was evidently with the same conviction that the Danish authorities and the Danish people at large accepted Dr. Cook's stupendous claim in a spirit of loyal belief, which appears never to have wavered until the fiasco of the receipt of his so-called data by a committee of the University of Copenhagen. These gentlemen very quickly reported that Cook's statement was the same as that printed in a New York newspaper; that the copy of his notebooks contained no original astronomical observations whatsoever, but only results; that the documents presented were inexcusably lacking in information which would prove that the astronomical observations therein referred to were really made; and that they contained no details regarding the practical work of the expedition and the sledge journey which would enable the committee to determine their reliability.

By this sweeping repudiation of Dr. Cook's claims the University of Copenhagen has drawn the final curtain upon one of the most spectacular dramas of audacious imposture in the history of geographical research.

Second only in importance to Peary's achievement in reaching the North Pole was Lieut. Shackleton's wonderful journey in the Antarctic, when he succeeded in reaching latitude 88 degrees 23 minutes south, and arrived within 111 miles of the South Pole. Shackleton passed the very point reached by Scott in 1903, pushed on for 325 miles, and was defeated in his quest by hunger, fatigue, sickness, and the loss of his dogs and ponies. He discovered eight new and distinct mountain ranges and over one hundred mountains, and ascended Mount Erebus, the most southerly volcano. The south magnetic pole was reached at 72 degrees 25 minutes.

Civil Engineering

With the single exception of the harbor at Dover, the past year has not been notable for the completion of any engineering works of the first magnitude. This stupendous work, by which a harbor capable of floating a whole fleet of the largest warships has been wrested from one of the stormiest seas in the world, consists of an aggregate length of over two miles of breakwater, much of which is nearly 100 feet in height from its foundation to its crest. It incloses about one square mile of area and cost some twenty million dollars.

In spite of many predictions of failure, the United States government, through its army engineers, is building the Panama Canal with a rapidity which augurs well for its opening by January 1st, 1915. Over one-half of the excavation at the Culebra cut has been done, and if we include the work done by the French, the cut may be considered as two-thirds completed. On the Atlantic side between three and four miles of the entrance channel have been completed, and on the Pacific side the channel is open to full depth for about five miles. At Gatun the lock excavation is so far done that the laying of the concrete floor and the building of the walls is well under way, and over eighty thousand cubic yards are already in place. The cut for the spillway has been completed, and here also concreting is making good progress. The method of building the Gatun dam by hydraulic depositing is being followed with every promise of securing a perfectly watertight structure. The locks, which will be in pairs, will be 110 feet in width, with a usable length of 1,000 feet. They will be provided with an extra pair of heavy mitering gates to act as collision bulkheads. Plans have been completed for an emergency dam at the head of the locks, which, in the event of a gate being carried away, will be swung across the entrance and wickets resting on girders extending from the bridge to sills below will be successively lowered until the flow of water is cut off. Throughout the whole length of the canal the method of excavation by steam shovel has been eminently successful, and during the month of March a maximum record of excavation was reached of 3,880,237 cubic yards. The health conditions have shown steady improvement, and the rate of sickness and mortality is now less than in some parts of the United States. The increasing size of ships, both merchant marine and naval, has led the German government to undertake a great enlargement of the Kaiser Wilhelm Canal, which is to be deepened to 36 feet, with provision for a later deepening, if necessary, to 46 feet. The width of the canal is to be doubled, and the locks will be 147 feet broad, 46 feet deep, and 1082 feet long. During the year work has progressed steadily if somewhat slowly upon that other great work of canal excavation known as the New York State Barge Canal. While it must be admitted that there can be no comparison on the score of accommodation between a canal 12 feet in depth with one 46 feet deep, it must be remembered that, whereas the Panama Canal is but 50 miles in length from deep water to deep water, the New York Barge Canal extends for nearly 400 miles. On June 22nd the first sod was turned in the work of cutting the Cape Cod Canal, which will extend for eight miles from Barnstable Bay to Buzzard's Bay. It will have a surface width of 300 feet, a least depth of 25 feet, and a high-water depth of about 30 feet. The sailing distance between New York and Boston will be shortened, and vessels will avoid the perils of the outside trip around Cape Cod. Furthermore, it will serve as the first link in a chain of interior waterways by way of Long Island Sound, New York Bay, and the Raritan and Delaware Rivers to Chesapeake Bay. During the year the agitation for the construction of a waterway from the Lakes to the Gulf has been exceedingly active, although the advocates of this great scheme were discouraged by an adverse report of the board of government engineers appointed to investigate the problem. This board reported that although the construction of a 14-foot channel was feasible, there was not sufficient traffic in sight to warrant the expenditure of the $160,000,000 that the whole project would cost. The great Los Angeles Aqueduct, which, outside of the Panama and State Barge canals, is the largest hydraulic engineering work in progress, is now about half completed. This wonderful structure will be capable of conveying 259,000,000 gallons of water per day from the Sierra Nevada Mountains over the Mojave Desert to San Fernando Valley, where it will provide water for city supply, for power, and for irrigation.

Throughout the year the work of the United States government in the reclamation of arid lands has been carried on with gratifying results. This work contemplates the ultimate reclamation of some 30,000,000 acres. It is divided into twenty-eight different projects, which are scattered throughout the Western, Middle, and Southwestern States. By the end of next year it is expected that nearly 2,000,000 acres will have been brought under cultivation at an estimated cost of $70,000,000. At the present time over 1,000,000 acres are under irrigation, and upon this newly-recovered land towns and villages are springing up, and an excellent class of citizens is taking up its abode as permanent settlers. The most interesting of these works completed during the year was the Gunnison Tunnel—10½ feet by 12 feet in cross section—which has been driven through the mountain and is now being used to divert the Gunnison River into the fertile Uncompahgre Valley.

The herculean task of hewing out of the solid rock of Manhattan Island the needed space for two of the largest railway terminal stations in existence, and building within and upon them adequate train shed and terminal accommodation, has proceeded apace during the past year. The Pennsylvania Terminal is practically completed, as are also the connecting tunnels with New Jersey and Long Island. The present indications are that this great work will be thrown open for public use early in the summer of this year. The work of excavation, which had been temporarily all but suspended on the New York Central Terminal, has been prosecuted with such vigor during 1909 that all but two tracks of the old train shed have been removed and the rock excavated to about 45 feet below the street level. It is greatly to the credit of the engineers and contractors that the gradual transfer of tracks from the old to the new level has been made without the slightest interference with traffic. The difficulties of the work make it likely that three years will elapse before it is entirely completed. The extensive rapid transit system known as the Hudson Tunnels has now been opened for public service practically in its entirety, the downtown tunnels from Jersey City to Cortlandt Street having been put in service during the year. A franchise has been granted to the company for an important extension from Sixth Avenue and 33rd Street to the Grand Central Station. This important connection will enable passengers from New England to the South and West to travel by rail from the Grand Central Station to the trunk line terminal stations in Jersey City.

The close of the year witnesses the practical completion of the Manhattan Suspension Bridge across the East River, which is now spanned by four out of the five great long-span bridges of the world, the fifth being the notable Forth Bridge in Scotland. The Manhattan Bridge, which is of the suspension type, has the largest carrying capacity of any bridge in the world, provision being made for four rapid transit tracks, four surface tracks, one 35-foot roadway, and two 11-foot footwalks. The main span measures 1470 feet, and the width of the suspended floor is 120 feet. Its total cost is $26,000,000. A recent report by the engineer appointed to examine into the question of the safety of the bridge pronounced this great structure to be thoroughly adequate to carry the loads imposed. The structural modifications recommended by the commission which investigated the Queensboro Cantilever Bridge over the East River with a view to decreasing the total dead and live load have been made, and this structure also may be regarded as perfectly safe for the modified loading adopted. The commission of engineers which have the re-designing of the Quebec Bridge in hand are still at work upon the plans, and as yet no statement has been made either as to the character or capacity of the new bridge, although we understand that there is a possibility of the suspension type being adopted in preference to the cantilever—a wise substitution.

Naval and Military.

Progress during the past year in matters naval and military may be considered as decidedly satisfactory. Several ships have been completed, chief among which are the "South Carolina" and "Michigan," the first all-big-gun battleships of our navy. These vessels, which are of 16,000 tons displacement, carry each four 45-caliber 12-inch guns. The "Michigan" on her official trial maintained an average speed of 18.97 knots. The "Delaware" and "North Dakota," dreadnoughts of 20,000 tons displacement, carrying each ten 12-inch 45-caliber guns and fourteen 5-inch guns, have passed through their trials successfully, the "Delaware," driven by reciprocating engines, averaging at full power a speed of 21.44 knots, and the "North Dakota," driven by Curtis turbines, averaging 21.83 knots. The "North Dakota" showed a higher water rate and a lower coal consumption than the "Delaware," and the naval officials are particularly gratified at the unexpectedly low coal consumption of the turbine-driven ship at cruising speed. Our third pair of dreadnoughts, the "Florida" and the "Utah," of 21,825 tons displacement and the same armament as the "North Dakota," will be launched in the spring of the present year, and work is about to be commenced upon those great ships, the "Arkansas" and "Wyoming," carrying twelve 50-caliber 12-inch guns on a displacement of 26,000 tons. Particularly gratifying has been the speed developed by our latest destroyers of the "Reid" type, the "Flusser" having averaged 32.67 knots and the "Reid" 32.75 knots in five runs over a measured mile. The vessels of this class are fine seaworthy boats of 700 tons displacement. Equally favorable results have been obtained with our latest submarines, the largest of which, the "Narwhal," has maintained a speed of 14 knots on the surface and 10 knots submerged, which performance, as far as we know, has not been surpassed in any foreign navy. During the

year the Editor had an opportunity to make a 20-mile trip in one of these vessels, and he can testify to the remarkable ease and accuracy with which the craft was maneuvered. Unquestionably submarine warfare has at last come into its own, and is destined to be a potent influence in deciding the issue of future naval operations. Lattice masts have been fitted to all of our battleships, and, as affording a fire control platform, they have proved a decided success. The gunnery of our navy continues to maintain its high excellence, and our shooting is believed to be now second to none in the world. Mention should be made of a greatly improved British torpedo, which has a diameter of 21 inches and is credited with a speed of 31 knots over a range of 7,000 yards. The increasing size of battleships has raised the question of increasing the size and draft of drydocks—a most serious consideration. During the year a contract was let for the large drydock at Pearl Harbor, Hawaii, and a new contract has also been let for the big drydock at the Brooklyn navy yard, New York. At the present time only our largest drydocks could float the new "Wyoming" over the sill at high water, and then with but a slight margin to spare.

The new 12-inch 50-caliber type gun, of the kind which is to be mounted in our 26,000-ton ships, has shown, in the Proving Ground tests, an initial velocity of 3,030 feet per second and a muzzle energy of 52,500 tons. Greatly exceeding this in power will be the new 14-inch navy gun, recently completed at the Midvale Works, which will fire a 1400-pound projectile with a muzzle energy of 65,600 tons. The new army 14-inch gun will be less powerful, but its accuracy life will be greater. It will be capable of firing 250 rounds, as against 80 to 100 rounds which is the limit for the present high velocity 12-inch army gun. A comparison of the sea strength of the powers at the close of the past year places Great Britain first, the United States second, Germany third, France fourth, and Japan fifth. When all ships now building are completed, Germany will be second with 820,692 tons, and the United States third with 789,687 tons displacement. In dreadnoughts Great Britain stands first with seven completed, and nine building, Germany second with two completed, and nine building, and the United States third with two completed, and four under construction. Of pre-dreadnought battleships carrying guns of 11 inch caliber or over, Great Britain has forty nine, the United States, twenty-five, and Germany, fourteen.

Merchant Marine.

The deplorable decadence of our merchant marine has continued throughout the year, and we look in vain for any adequate evidence of the awakening of the nation to the seriousness of this pre-eminently national question. As a measure of security and defense, the existence of an adequate number of merchant ships to serve as transports and colliers in time of war is vital to the efficiency of our navy. Although, during the world cruise of our fleet, the world looked on approvingly and applauded this evidence of material strength, the people who know—the naval boards of strategy and naval officers in general—must have smiled as they realized that, because of our want of transports and colliers, a voyage of this character would never be seriously contemplated by our naval board, and certainly never attempted. The signs of decadence of our merchant marine are so clearly written that he who runs may read. Within two years the number of American steamers crossing the Pacific and capable of carrying the mails has been reduced more than one-half. The year before last the Post Office Department recommended, and the Senate passed a bill providing for a compensation of so much per mile to steamers running to South America, the Philippines, Japan, China, and Australia, but the measure failed to become law. It is certain that without such federal encouragement American steamship lines will never be established, and until the construction of mail steamers and freighters is encouraged, our splendid navy will be robbed of its efficiency and limited, at least in the opening months of a war, to the defense of its own ports.

The past year will be notable in the annals of transatlantic travel for the fact that a transatlantic liner made the passage for the first time at an average speed of 26 knots an hour. This was accomplished last October, when the "Mauretania" covered the westward course from land to land in 4 days, 10 hours, and 51 minutes, at an average speed of 26.06 knots. Both this vessel and her sister, the "Lusitania," are now capable of 25 knots sustained speed in average weather and 25½ knots during the quiet weather of the summer season. Work on the two enormous White Star boats, the "Titanic" and "Olympic," has proceeded rapidly. The former vessel is already in frame, and she will probably make her first trip in 1911. The dimensions of these ships, as announced by the company, are: [illegible] feet over all, 9[illegible] feet beam, and maximum displacement [illegible],000 tons. The speed is to be 21 knots with [illegible],000 horsepower. The success of the turbine [illegible] has been settled, beyond all question. The substitution of four-bladed propellers of smaller diameter for three-bladed propellers on the outer shafts of the Cunarders has not only completely eliminated what vibration there was, but by improving propeller efficiency has considerably increased the speed. There is no evidence that any company will attempt to rival these vessels in speed, and probably future development will be along the lines of the "Olympic" and "Titanic." These moderate-speed vessels are to be driven by a combination of reciprocating engines and turbines, the reciprocating element being used in the higher ranges of expansion, in which it is more economical than the turbine. In a recent trip to New Zealand a merchant vessel, the "Otaki," fitted with engines and turbines, made the same average speed as the sister ships "Orari" and "Opawa," fitted with reciprocating engines alone. Her coal consumption was 11 per cent less, and there was a reduction of 20 per cent in the water consumption, all three ships having the same boiler installation. In this combination, when reversing, the turbine is cut out and the reciprocating engines are connected directly to the condenser. Toward the close of the year two interesting devices, designed to reconcile the slow-speed demands of the propeller with the high-speed demands of the turbine, were made public. One, designed by Admiral Melville and Mr. McAlpine, consists of a reduction gear of the helical type interposed between the turbine and propeller shaft. The other, designed by a German engineer, employs a form of hydraulic turbine transmission, in which the ratio of turbine speed to propeller speed can be varied indefinitely. For both devices a high efficiency rate is claimed. The Curtis turbine, because of its large diameter, and comparatively low speed of revolution, has less trouble from propeller inefficiency than the Parsons type. The loss of the "Republic" early in the year gave dramatic evidence of the value of wireless telegraphy as a safeguard to the safety of passengers and ships. It served also to draw attention to the question of bulkhead protection. Theoretically, the "Republic" should have stayed afloat long enough to be brought into port. It is probable that she sank because of the gradual failure of her bulkheads, one by one. On the other hand, the value of bulkhead protection was proved by the fact that the colliding ship, the "Florida," with 30 feet of her bow crushed in, was able to make port in safety. An important event for the navigator was the launch of the magnetic survey yacht "Carnegie," into the construction of which no steel, iron, or other magnetic material entered. She was built for the Carnegie Institution at Washington, and her surveys of the ocean will form part of a comprehensive survey of the whole world on land and sea for the determination of the exact local magnetic variations of the compass. An interesting novelty in hull construction was seen in the "Monitoria," whose hull is built with large corrugations, the object of which is to increase the longitudinal strength of the ship, without increasing the weight. The extra cost is slight, and the carrying capacity is said to be increased from three to four per cent.

Railroads

The most surprising fact in railroad development during 1909 was the continued and very considerable increase in the size of passenger and freight locomotives. So marked has this been, that we have ceased to hear anything of late about the "limits of size having been surely reached." The adoption of the Mallet articulated system has made this increase possible. Two locomotives built by the Baldwin Company may be quoted as instances of this construction. A freight locomotive for the Mountain Division of the Southern Pacific Railway, built a few months ago, has 6,393 square feet of heating surface, the engine weighs 213 tons, and the engine and tender together weigh just under 300 tons. Toward the close of the year the same company built for the Atchison, Topeka & Santa Fé Railway a still larger locomotive, with 6,631 square feet of heating surface and 1,745 square feet of superheating and reheating surface, the engine alone weighs 231 tons, and the engine and tender together 350 tons. The most novel and important departure in the new passenger engines of the year is a huge Mallet 16-wheel locomotive, with two high-pressure 24-inch cylinders driving six coupled 73-inch wheels, and two 38-inch low-pressure cylinders driving four coupled 73-inch wheels. The total heating surface is 4,756 square feet, and there are 1,121 square feet of superheating and reheating surface. The engine weighs 188 tons, and the engine and tender together 305 tons. Such an engine will be able to haul the exceedingly heavy American express trains at a rate of speed equal to that of the lighter European trains. Most encouraging has been the great improvement in the quality of steel rails delivered from the rail mills. Reports of the Public Service Commission of New York State show that whereas during the winter of 1907-8 there were 2,917 cases of rail failure reported, during the winter of 1908-9 the total number was 1,[illegible]—a better showing, but leaving room for much further improvement.

It is encouraging, also, to note a decrease in the number of railway accidents. This is due in some measure to the increasing application of the block signaling system, which now, except for a few short distances totaling about 100 miles, extends unbroken from the Atlantic to the Pacific coasts. Great activity is also being displayed in the development of various forms of automatic signaling, and particularly of that class of devices which acts directly on the train, and presents some visual or audible signal in the engineer's cab. A device of this character for automatically and gradually applying the air brakes was recently tested on the Erie tracks with excellent results. In spite of the several attempts to give it practical application, the monorail system is making but slow progress. The latest, and as far as experimental tests go the most promising, is the Brennan gyrostatic railway, which is receiving support in Europe, notably from the officials of the British army. The little experimental car exhibited in the spring of 1907 has been followed by a full-sized car, weighing 22 tons and carrying a load of 40 passengers, which has made successful trips on an experimental track. The present indications are that the system may find useful application on light railways, acting as feeders to the main steam or electric lines.

Astronomy, Photography, and Chemistry.

The year 1909 is astronomically memorable for the return of Halley's famous comet. On September 11th last, Dr. Max Wolf of Heidelberg discovered this historic wanderer upon one of his photographic plates in almost the exact position which the calculations of Cowell and Crommelin called for—a feat which may be regarded as a triumph of mathematical astronomy. The comet will pass perihelion on April 20th, and will be a conspicuous object in the western heavens after sunset about the middle of May, at which time the earth will pass through a portion of the comet's tail, and the comet itself will cross the sun's disk. The reappearance is therefore of exceptional interest, because it will give astronomers an opportunity of obtaining much valuable information as to the comet's structure.

The year was further signalized by the discovery of another comet by Mr. Daniel of the Princeton Observatory—the third he now has to his credit.

On September 24th, 1909, an opposition of Mars occurred—the most favorable which astronomers can possibly have for another fifteen years. On that date the planet was distant 35,500,000 miles. Naturally, the old question of Martian habitability was revived. Prof. Pickering, in order to settle it once and for all, proposed a method of signaling by mirrors, and Prof. Wood of Johns Hopkins University suggested a method of "winking" by means of black cloths on reels. Neither astronomer probably believes in intelligent life on Mars, but was actuated solely by a desire to close a wearisome, perennial debate. The theory of habitability depends very largely upon the presence of water on Mars. Dr. Campbell, director of the Lick Observatory, made a careful comparison last year of the spectra of the moon and Mars. He found that there was no appreciable difference between the two, from which he infers that Mars must be practically waterless and therefore as dead as the Moon. Mr. Very, of Prof. Lowell's staff, on the other hand, has arrived at a directly opposite conclusion. So far from being decided, the old question is therefore more alive than ever.

There were two eclipses of the Sun and two of the Moon. The lunar eclipses were both total and occurred on June 3rd and November 26th. The eclipses of the Sun, occurring on June 27th and December 12th, were respectively central and partial.

As might be expected, the radio-active elements still continue to engage the attention of chemists. Although during the year 1909 no very dramatic discovery was made, Ramsay, Soddy, and Debierne made important announcements. Sir William Ramsay sealed up some radium bromide in a bottle together with water, and observed the regular evolution of the gas (hydrogen and oxygen) at the rate of 30 cubic centimeters per week. After nine months this evolution ceased almost entirely, from which Sir William Ramsay concluded that either the radium salt had lost its capacity for decomposing the water or that the velocity of the reverse action (the re-combination of oxygen and hydrogen to water) predominated over that of decomposition. These results are questioned by Debierne, who decomposed water by the direct action of rays, keeping the radium salt and the water in separate glass vessels. Whichever chemist ultimately proves to be right, the investigation is interesting, because it is the first attempt to apply practically the enormous store of energy which is contained in radium and which may be gazed when it is stated that, during disintegration, radium emits two and one-half million times as much heat as an equal volume of hydrogen and oxygen combining explosively to form water. The work of Soddy for 1909 has shown

(Concluded on page 8.)

OXYGEN AND HUMAN ENERGY.

BY JOHN B. HUBER, A.M., M.D.

Oxygen is the life-maintaining gas. It is the most useful and the most abundant of all the elements as we still call them. Its combination with other substances—oxidation—makes heat; and that is why the sentient body is generally warmer than the atmosphere about it. All animal and vegetable life depends upon oxygen; under the sun's benignant influence the plants give out this gas, which, thus freed, is respired in animal life. And by the term respiration in the physiological sense we mean not only the series of acts known as breathing, but also that in respiration oxygen is carried from the lungs by the blood, through the minutest capillaries, to the uttermost cells and the most microscopic tissues of the body, giving to it strength and warmth and life.

In point of fact life itself in our present knowledge is inconceivable without oxygen, which is much more important than food to the human economy. Without the latter one may exist for months; without the former one must die within a few minutes. Consider also metabolism. Normal metabolism is the perfect chemical transformation of oxygen, fluids and food stuffs into healthy tissues. The process is a never resting, an ever changing one. Respiration provides the oxygen; ingestion provides the fluids and the food stuffs. And in that infinitely complex laboratory, the animal body, these substances are combined in the constant manufacture of fresh cells and tissues to take the place of those which are as constantly dying and being removed by way of the lungs (carbon dioxide and watery vapor) and the excretory organs.

We are thus able to appreciate one of the most valuable dicta of the evolutionists, that normal living is the right adjustment of internal relations to external relations; again, whatever amount of power an organism expends in any shape is the correlate and equivalent of a power that was taken in from without. In our physical life—as also in our psychic, for that matter—we are absolutely dependent upon a wholesome environment for wholesome existence; and by far the most essential and the most beneficent element which our environment affords us is oxygen. It is here very important to note that nature does not vouchsafe us this oxygen pure; she has tempered it for our use by combining about one part of it with about four parts of nitrogen (an inert component). Oxygen pure is irritating; and ozone, a form of oxygen in which three atoms are considered to be condensed into two—has in experiments been found so caustic as to produce pulmonary inflammations. The safest and the only good and right form of oxygen inhalation for normal creatures is in combination as it exists in the atmosphere; for this is the form to which during many ages the race has become adapted. It is possible that in other æons creatures respired oxygen under a different combination than that which now obtains; but in those æons there were no human beings—only such creatures as ichthyosauri and the dodo. No; we can live most advantageously, most wholesomely, and with the best human results only in conformity with natural laws as we find them, and with due respect and regard to our environment.

There are, however, abnormal states of the human body in which oxygenation is deficient by reason of disease processes; and in these diseases it is sought to administer oxygen in greater proportion than obtains in the ordinary atmosphere. We give it thus when oxygenation of the blood is interfered with, as in dyspnœa, emphysema, asthma, croup, whooping cough, asphyxia, tuberculosis and pneumonia; and when the oxygen proportion in the blood is poor, as in anemia, diabetes and chlorosis (the green sickness). Here Hayem's findings are, I believe, authoritative. In such diseases as those just mentioned *oxygen mixed with a determinate quantity of air* energizes to a considerable degree the nutritive functions, increases the appetite, slightly elevates the temperature, stimulates the cardiac movements and augments the bodily weight; the number of red blood cells is increased and their organic activity is stimulated, although this action is not constant, the effects may become so by the greater nutritive changes that are thus promoted."

Observe now the portion of Hayem's statement which I have italicized. In point of fact even in disease we do not, as we could not, administer oxygen pure; moreover the nurse in administering holds the tube in such manner between the parted lips that some admixture of air takes place; this admixture is essential if the oxygen is to be respired at all. Nor have I, for my part, been always sure of the efficacy of oxygen in such diseases as pneumonia. I have felt that pure atmospheric air—the colder the better its tonic properties—has been as efficacious as oxygen in cases *in extremis*. Some physicians indeed go so far as to declare that the appearance of the oxygen tank connotes the beginning of the end for the unfortunate patient.

Apparatus for registering work performed after inhaling oxygen.

OXYGEN AND HUMAN ENERGY

Nor does the oxygen tank supplied for use in the sick room contain pure oxygen. One of the firms which supplies this gas for the sick room informs me that their purest oxygen is 90 per cent, the remainder being nitrogen; that in half the cases physicians prefer and call for tanks containing *oxygen compound*, which is made up of 60 per cent oxygen, 30 per cent nitrous oxide (laughing gas) and 10 per cent nitrogen.

I find it now very *apropos* to present certain physio-

(*Concluded on page 16.*)

ELECTRICAL HEAT PENETRATION.

BY [illegible]

When fever was recognized as a natural process by which the body endeavors to expel invading microbes, the idea was suggested to effect artificially a local increase in the temperature of those parts of the body which are affected by disease, thus assisting the human organism in its struggle against the morbid process. In fact, an artificial heat supply is obtained by the familiar methods of treatment which have been in use from time immemorial. However, there was so far no possibility of really permeating the body with heat, any effects being merely superficial, resulting at most in a general heating of the whole body, the excess of which is known to be counteracted by abundant perspiration and fixation of heat through evaporation.

The process described in the following paragraphs allows any part of the body to be heated to any temperature desired, producing locally fever temperatures of say 100 degrees to 104 degrees F. in order thus to increase blood circulation and to accelerate and intensify all those vital processes which are instrumental in defeating the disease. The local heating is effected by means of electric currents.

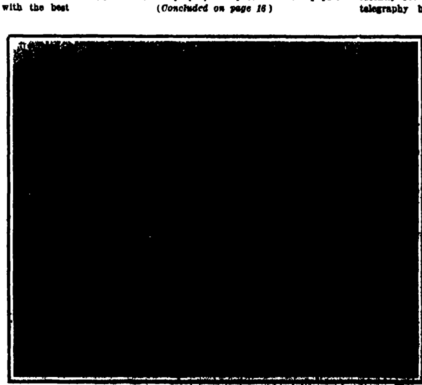
Though almost any galvanic action is attended by the production of heat, the amount of heat generated by ordinary currents is insignificant. Any attempt to produce an appreciable heating effect by the application of electricity would further have been frustrated by the small amount of energy supplied to the human body in the form of ordinary currents, while any really important increase would have resulted in a violent stimulus of the nervous system and the electrolytical destruction of tissues. Intensities of 50 to 100 milliamperes thus constituted the extreme limit even in the case of small current densities, whereas twenty to fifty times as much current would have been required for the production of an adequate heating effect.

High frequency currents as lately used in connection with wireless telegraphy afford a means of applying enormous amounts of current energy to the body without any risk of injury. In fact these currents perform vibrations of such rapidity as to exceed the limits of excitability of our nervous system. The alternations in current direction also exclude any electrolytical effect.

The electrical vibrations generally used are too strongly damped to yield an appreciable effect. As in two communicating tubes a liquid removed from its position of rest will oscillate to ever-decreasing distances from its position of rest, so electric waves starting from a spark gap become smaller and smaller, and only after an interval about two hundred times as long as those vibrations will a new discharge take place and generate a new set of vibrations. In order to increase the effect of these vibrations the intervals should be reduced to about the same duration as the vibrations themselves. Their effect would then be entirely equivalent to those undamped waves which have recently been generated for the purposes of wireless telegraphy by means of highly sensitive apparatus.

A Berlin firm has recently constructed an outfit for generating high frequency vibrations, thus making heat penetration accessible to medicine as a new therapeutic method.

The most important part of the outfit, viz., the apparatus used to generate the vibrations, consists of two substantial copper electrodes separated by a small distance, between which the electrical discharges pass in an inclosed compartment. These discharges are produced by the high tension of an electrical generator connected with the electrodes, and a vibratory circuit connected up in parallel with it, and consisting of a condenser and a self-induction coil arranged in series. The condenser is charged suddenly as the apparatus is inserted, and the discharge, which ensues immediately, takes the shape of a rapidly extinguished spark between the copper electrodes. In a similar manner, as an object fixed by an elastic rubber string on [illegible] [illegible]



AN APPARATUS FOR PRODUCING LOCAL HEAT PENETRATION.

which is soon compensated by a reflux, which in its turn exceeds the normal condition, and so on Hence the processes in the vibratory circuit are comparable to an elastic pendulation.

So far from being applied directly, the vibrations generated by the condenser circuit are at first raised by induction to a convenient tension, which is graduated by shuntings from the secondary coil. The current is supplied by means of conductors to the electrode plates, to be applied to the body after first passing through an ammeter

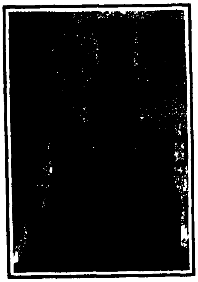
This thermo-penetration outfit can be operated by direct connection with an alternating-current circuit, the tension being raised by a transformer before entering the generator When continuous current is used a small converter, resembling an ordinary electric motor, serves to convert it into an alternating current

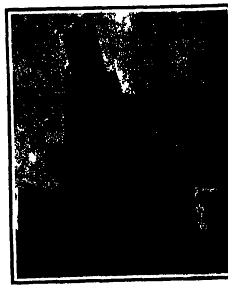
AN AUTOMATIC APPARATUS FOR PROJECTING PICTURES

BY JACQUES BOYER.

Radiguet and Massiot of Paris have patented an automatic projecting lantern, which they call the "Circus" It consists of an electric lantern provided with an endless chain of slide holders, which are brought successively between the condensing and projecting lenses by a double system of hooks During the movement of the slides, the light is automatically cut off by a shutter, so that the image does not appear on the screen until it has become motionless

The lamps are self-regulating and designed for tensions of 7, 15, and 20 volts The position of the arc is rigorously fixed and the carbons are inclined producing the maximum illumination The focal length of the condensers is about 5 inches The projecting lens can be focused by a rack and pinion, and covers a screen 3 yards square at a distance of 9 yards The mechanism is operated by an electric motor of 1/40 horsepower, placed in the base of the apparatus The apparatus is set into operation by moving a single key and the projection of pictures then continues—or may continue—as long as the carbons last or about 8 hours although the 100 slides which the apparatus accommodates are run off in from 30 to 45 minutes according to the speed to which the mechanism is adjusted. The automatic projector saves the expense of an operator and should interest all proprietors of projecting apparatus, and lecturers in general. In the theater it will replace advertisements painted on the curtain, in railway stations it may be employed to show the scenery along the line, and in newspaper offices it will prove more useful and effective than written bulletins or projecting lanterns of the ordinary type





AN AUTOMATIC APPARATUS FOR PROJECTING PICTURES.

THE SCIENTIFIC AMERICAN TROPHY

The year 1909 has closed with only a single trial for the SCIENTIFIC AMERICAN Flying Machine Trophy That the publishers are disappointed in this lack of interest in the sport goes without saying Up to the present time Mr Glenn Curtiss to his credit, is the only American aviator who has displayed an interest in a prize which the publishers of this journal donated at considerable expense for the purpose of encouraging the development of an art which, thanks to Langley, had its scientific genesis in this country Were Curtiss our only aviator we could understand why he alone should present himself as a contestant. There are at least three other American flying-machine pilots in the field with whom Mr Curtiss would surely have coped with pleasure The conditions under which Mr Curtiss won the Trophy for the second time last year were by no means onerous. The deed of gift to the Aero Club of America provided for an annual competition by heavier-than-air machines only, with the understanding that the conditions governing the contest were to be changed from time to time so that they would keep pace with the progress made in the designing and building of flying machines. In this [illegible] it was hoped that not only aeroplanes, [illegible] of flying machines, such as helicopters and beating-wing machines, would receive encouragement. The conditions required at first were a straightaway flight of one kilometer (0 621 mile) in a straight line. On July 4th, 1908, Mr Glenn Curtiss carried off the Trophy by covering somewhat more than a mile in the "June Bug" In view of the flights which were then being made by French aviators the conditions were changed for 1909 to 25 kilometers (15½ miles) in a closed circuit, in other words 5 kilometers (3 1 miles) more than required in the International Contest for the Bennett Trophy Under the 1909 rules the winner for any year is the aviator who makes the longest and best flight in a closed circuit during that year In 1909 Mr Curtiss was the only competitor who came forward He easily complied with the conditions and accordingly he must be regarded as the winner of the Trophy for the year 1909 His achievement is remarkable, because he flew double the distance required in the Bennett Cup Race

The lack of entries for competition during 1909 was certainly not due to formidable conditions as the Aero Club, in establishing the rules for the year endeavored to make them so easy that any aspiring experimenter would feel that the Trophy would be well within his reach The discouraging fact remains that during the past year in spite of the notable achievements of Curtiss and the Wrights very few new men have come into the field Reports reach this office from various parts of the country that machines are being built but successful flights are few and far between In France during the past year the science of aviation has advanced by leaps and bounds as was witnessed by the successful flights at Rheims and Juvisy and by the almost daily reports of successful trials of new machines or long cross country flights by well known aviators There are fortunately a number of men in various parts of the country who are making serious experiments and it is to be hoped that great strides will be made during the year 1910 and that the competition for the Trophy will bring into the field a large number of new experimenters

Possibly the present lack of progress is due to the fact that in America at least the aeroplane is not as yet what may be called a commercial product It was not until the automobile had become a serious competitor of the horse drawn vehicle that the Bennett and Vanderbilt cups and other automobile racing trophies were earnestly competed for Perhaps the history of aeronautic sport may be the same and that when aeroplanes are manufactured wholesale the flying machine will hold a recognized position in the sport of the country In France we believe there are no less than a dozen establishments actively engaged in the making and selling of aeroplanes This placing of the flying machine upon a commercial footing undoubtedly has played its part in popularizing the monoplane and the biplane among Frenchmen For all that however there must have been popular enthusiasm before the industry could have been started —an incentive which was not that of making money We hope that in 1910 Mr Curtiss will again be a competitor that he will pit himself against men who are worthy of his steel and that a contest will be inaugurated which will arouse in this country something like the enthusiasm which was evinced at Rheims

The conditions which will govern the contests for the cup in 1910 will be announced later They will be so drawn as to keep pace with the progress made last year

SCIENTIFIC AMERICAN TROPHY

Won in 1908 and 1909 by Glenn H. Curtiss.

A table prepared for the Archiv für Eisenbahnwesen states that at the commencement of 1908 the total railway mileage of the whole world was 594 842 miles divided as follows America 302 928 Europe 199 346 Asia 56 484 Africa 18 518 and Australia 17 766 The cost of construction per mile has been highest in Great Britain and Ireland where it averaged $271 000 per mile In Belgium the cost was $172 900 France $122 000 Germany $108 500 Italy $12 300 Russia $79 600 per mile In the United States the average cost has been $68 800 in Canada $18 000 in New Zealand $60 300 and in Queensland Australia it is as low as $34 200

The boring conducted by the Prussian Department of Mines at Czuchow in Silesia had to be discontinued recently upon reaching a depth of . .40 meters in view of the fact that the cost of drilling at this depth in hard sandstone was out of proportion to the obtainable results Like the boring at Paruschowitz in Silesia which had to be abandoned at a depth of 2 003 meters on account of the drills breaking the Czuchow boring was undertaken for scientific purposes only since mining operations are of course entirely impossible at this depth, even if no account is taken of the rapidity with which the expense for hoisting increases with depth

RETROSPECT OF THE YEAR 1909.

(Concluded from page 5.)

without question that helium is produced from uranium as well as from radium, the amount being two milligrammes of helium annually from over a million kilogrammes of uranium.

In photography we find an interesting attempt to present moving pictures in colors by several inventors—Barricelli, Friese-Greene, and Urban and Smith. Curiously enough, all three inventions are based upon the same principle of so rapidly presenting images colored red, yellow, and blue that the eye has no time to notice the successive presentations, and therefore combines them into one picture In the same field of chronophotography must be mentioned the important application of the moving picture machine to the ultra microscope by Dr Comandon, an application somewhat similar in principle to the combination of the ordinary microscope and kinetoscope made by Dr Robert K Watkins of this city over ten years ago Comandon's invention promises to be of considerable educational value in actually enabling us to see the struggles of our blood corpuscles with their microbic enemies.

Electrical.

In view of the great advance in its efficiency, the tungsten lamp is entitled to be considered the most notable improvement of the year in the field of electricity Mention should be made, however of the important hydraulic-electric plant in Norway for reducing nitrogen from the air, which is being so successfully operated that its product is being sold in successful competition with the supply from Chili Also the calcium cyanamide fertilizer process, hitherto in the experimental stage, has, during the year, been demonstrated to be commercially practicable The Belin telephotographic process has been further improved, and in January of last year the new apparatus was successfully used between Paris and Lyons. The process of transmission is based upon the fact that a photographic plate in bichromated gelatin presents a series of elevations and depressions, advantage of which is taken for producing, by a tracing point, oscillating movements, and fluctuations in the transmission current. De Forest has improved on his system of wireless telephony as used upon our battleships during the world cruise, and a number of stations have been put in operation on the Great Lakes for communication with steamships. Communication has been established over the ninety miles separating Chicago from Milwaukee, and steamers have been in touch with the shore from a distance of forty five miles Gabet in France has achieved some success in the steering of a 29 foot torpedo by the wireless method previously tested by Tesla in this country and Armstrong in England The torpedo is driven by an internal-combustion motor, and immediately back of the explosive head is a compartment containing the wireless-controlled instruments It is claimed that the control is effective up to five or six miles. In recent tests the motor was started and stopped at will and the rudder was successfully operated from a small boat at a distance of a little over 100 yards. Mention should also be made of experimental wireless communications with a balloon, made by the United States Army Signal Corps by means of a 300-foot phosphor-bronze wire suspended below a balloon 1,000 feet in the air Communication was kept up from the Washington station until the balloon was about six miles distant, and messages were received from Annapolis over distances of from twenty to ten miles

The application of electric traction to steam railroads continues to show gratifying results. Although no figures have been made public as to its economy, the electrical operation of the suburban tracks and terminals of the New York Central and New Haven lines has been carried on throughout the year with unbroken success The New York Central electric zone is being extended to White Plains, and the New Haven Company are building a mile of experimental overhead line beyond Stamford, preparatory to the extension of the system to New Haven The latter company have also ordered two experimental freight locomotives, and it is the intention to operate the whole line from New York to New Haven, a distance of nearly eighty miles, with electric traction both for freight and passenger service The Pennsylvania Railroad Company are having fifty locomotives of 4,000 maximum horse-power built for the operation of their tunnels and terminals in New York city An important improvement in these engines is the removal of the motor from the axle and placing it above the frame, with a view to raising the center of gravity and reducing the stresses on the track and roadbed. Mention should be made here of a most important enlargement of the capacity of central power stations by the introduction of low-pressure turbines between the low-pressure cylinders and the condensers, in such power stations as are now operated by reciprocating engines. In the 59th Street power station of the New York subways the maximum output of 8 000 kilowatts of the big cross-compound engines has been increased to 16,000 kilowatts by interposing a Curtis turbine in this manner.

Aeronautics.

Great as was the advance made in aeronautics during 1908, it was far surpassed by the extraordinary developments of the past year, and when the history of this new art comes to be written, the sensational performances at the Rheims meet, and subsequently, will be referred to as marking the era of practical and thoroughly controlled human flight with the heavier-than-air machine. On July 30th, Orville Wright completed the government tests at Fort Myer by flying for ten miles across country at an average speed of 42.58 miles per hour with a passenger aboard, having previously made a flight with a passenger over a closed circuit which lasted one hour and twelve minutes. The government purchased the machine at the contract price of $30,000 What was probably the most popular performance of the year occurred on July 25th, when Bleriot made his successful 21-mile flight across the English Channel. At the great Rheims meet, which opened on August 22nd, no less than 38 aeroplanes were entered, of which 36 made successful flight, there being about an equal number of biplanes and monoplanes represented. Here the public witnessed the astonishing sight of as many as half a dozen aeroplanes in the air at one time, the pilots of which showed perfect control of their machines in the gusty winds that prevailed Both Bleriot and Curtiss proved how near the aeroplane had come to reaching the 50-mile-an-hour mark, the former winning the 6 21-mile race at a speed of 47 78 miles per hour, and Curtiss bringing home to America the International Cup by covering 12 42 miles at a speed of 47 04 miles per hour That the aeroplane possesses endurance as well as speed was proved by Farman, who won the long-distance race with a record of 111.88 miles covered in 3 hours, 4 minutes, 56 2/5 seconds. Subsequently to the meet, Farman, on November 3rd, at Mourmelon, France, made a bold bid for the Michelin Prize, held by the Wright brothers, by covering 144 miles in 4 hours, 17 minutes, and 53 seconds, and since, at the present writing, there is no indication that the Wrights will make an effort to retain the cup, it must perforce be returned to France During the Hudson Fulton Celebration in New York, Wilbur Wright proved his faith in the reliability of his machine by flying from Governor's Island up the Hudson River to Grant's Tomb and back again. Early in October Orville Wright in an exhibition at Potsdam, Germany, rose to the unprecedented height of over 1,600 feet, a feat which has since been approximated by Count de Lambert, Paulhan, and Latham. Count de Lambert's lofty ascension occurred during a flight from Juvisy to Paris and back, a distance of 30 miles, during which he flew above the Eiffel Tower An encouraging fact, pointing to the more complete mastery of flight, is the increased assurance with which aviators are now making their flights under unfavorable weather conditions Instances of this occurred both at the Rheims and at the Blackpool meets, when Latham passed successfully through heavy thunder squalls and also drove his machine around a closed circuit in the face of a wind which was heavy enough at times to bring him almost to a standstill Taken altogether, it must be admitted that the honors of the year are about equally divided between the monoplane and the biplane. Future developments will be in the direction of improved devices for starting and alighting, and the introduction of some form of device for securing automatic stability. A most encouraging feature is the great reduction which had been made in the weight of the aeroplane, Curtiss's machine weighing over 450 pounds and Santos Dumont's little "Demoiselle," which is credited with a speed of over 50 miles an hour, weighing, without the aviator, only 250 pounds. On July 17th, 1909, Glenn H Curtiss, by covering more than the necessary 15½ miles in a closed circuit, won the SCIENTIFIC AMERICAN trophy for the second time, his first success being scored in 1908. It is a strange anomaly that there should have been but a single competitor in the country which gave birth to the successful aeroplane.

In its own field the dirigible has made proportional progress both in speed and in endurance. Count Zeppelin with his powerful dirigible "Zeppelin III" is far ahead of all competitors; and his journey from Friedrichshafen to Berlin and back, a total distance of 800 miles, was a fine performance, and redounds to the everlasting credit of the veteran inventor. Other long-distance journeys accomplished by Zeppelin during the year were a trip from Friedrichshafen to Munich, a distance of 100 miles, in 4½ hours, made with "Zeppelin I," and a journey of 150 miles in 4 hours, during which the great dirigible carried no less than 26 men.

Automobile and Motor Boat.

The automobile has reached such a stage of perfection that the record of improvement is confined entirely to matters of detail—no striking novelties have been developed during the year. The high-powered car is now built almost exclusively for racing purposes. For touring, a limit of 40 to 50 horse-power is found to meet the requirements of the average purchaser. The principal development has been in the increasing popularity of the low-powered car of 20 horse-power; and it is now possible to procure a 4-cylinder machine embodying all the coveted features of long wheel base, light weight, and generally smart appearance, for prices varying from $750 to $1,000. The long-distance races have waned in popularity, and such racing as is now done is confined largely to contests between stock cars on inclosed tracks. For full details of the work of the past year reference is made to our forthcoming Special Automobile Number, which will handle the subject in its usual comprehensive manner. The power boat, propelled by the internal-combustion motor, is enjoying such increasing popularity, that it bids fair to reduce the sailing yacht to an entirely secondary position in public favor Mention should be made of a very creditable experiment made by Mr. H. L. Aldrich of International Marine Engineering, who equipped a 40-foot boat with a 35-horse-power 4-cylinder producer-gas engine. Extensive cruising during the past summer proved that the boat can cover over 800 miles at an average speed of 8 to 9 miles an hour on one ton of pea anthracite coal—a truly remarkable performance. The hydroplane motor boat, of which we heard so much two or three years ago, seems destined to remain what it has always been, an exceedingly interesting curiosity As a racer it has shown high speed, but not sufficient to enable it to win against the high-powered boat of standard practice. The fastest record of the year, and a world record, was established by a 600-horse-power English boat 49.2 feet in length with two 12-cylinder Wolseley engines, which won the principal race at Monaco last year over a 62 14 mile course at an average speed of 39 15 miles per hour

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Flying-Machine Manufacture.

Deputy Consul-General Simon W Hanauer reports from Frankfort that a limited stock company has been formed in Berlin by leading German industrial concerns for the purpose of manufacturing flying machines of the Wright system.

Wilbur and Orville Wright have given the new company, whose firm name is Flugmaschine Wright, G. m. b. H., the right to work all their patents, models, etc., for making aeroplanes in Germany The new company has a working capital of 500,000 marks ($119,200), its principal participants are Krupp Company, of Essen; A. Borsig Machine and Locomotive Works, Hugo Stinnes, coal and iron operator, Delbrueck, Leo & Co., bankers, Ludwig Loewe & Co, machine, arms, and tool manufacturers; Aerial Vehicle Company, Motor Air Locomotion Experimental Company, the General Electric Company, of Berlin, the Electro Chemical Company, of Bitterfeld. Capt von Kehler will be the managing director of the new company.

The Aviation Meeting at Los Angeles.

America's first aviation meet will be held at Los Angeles, Cal., from January 10th to 20th inclusive. Announcement has been made that prizes to the amount of $45,000 will be available for aeroplane contests, $22,500 for a long-distance balloon race, and $13,100 for dirigible balloon contests. Full particulars are not yet at hand, but we understand the aeroplane events will be for height, speed, and endurance. Paulhan, the record-breaking French aviator, is bringing over two Bleriot monoplanes and two Farman biplanes, and Messrs. Charles F. Willard and Glenn H. Curtiss are to make flights with the Aeronautic Society's biplane and one of Curtiss's latest machines respectively Roy Knabenshue, Lincoln Beachy, and other airship operators will compete in the dirigible contests. The meet has been sanctioned by the Aero Club of America. It offers the first opportunity Americans have had to see aeroplane contests and real flying by heavier-than-air machines.

The Automobile Shows in New York.

On New Year's eve the American Motor Car Manufacturers' Association will open its annual automobile show at the Grand Central Palace in New York city. This show of the "unlicensed" manufacturers will last a week. There are 325 exhibitors, and the total value of the exhibits is in the neighborhood of $1,100,000. Nearly 100 exhibitors of complete vehicles have space, while the exhibitors of parts and sundries are more numerous than ever before.

The Licensed Association of Automobile Manufacturers will hold their tenth annual show in Madison Square Garden from January 8th to 15th. The large special Automobile Number of the SCIENTIFIC AMERICAN will be issued in connection with the second show upon the latter date.

The gyrostatic railway car invented by Richard Scherl, a German, said to be an improvement on Brennan's car, is now in this country and will soon be given a public demonstration.

Aviator Hamilton's Flights at St. Joseph, Mo.

After learning how to fly a Curtiss biplane and making several excellent flights at Hammondsport, N. Y., the longest of which lasted 25 minutes, Charles K. Hamilton made some daring flights at St. Joseph, Mo., recently, as detailed below by our correspondent. The machine he is using is the same one that Mr Curtiss used at Governor's Island, New York, when he attempted to fly there during the Hudson-Fulton celebration. It is fitted with a 25-horse-power 4-cylinder water-cooled motor, and the planes have a 30-foot spread. The machine weighs some 560 pounds.

The first flight at St. Joseph was made on Sunday, December 12th, over a circular course above the frozen surface of Lake Contrary After two straightaway flights of a half kilometer against the wind and a kilometer with the wind in order to test the motor, the biplane ascended in a snow storm so intense as to be blinding to the spectators. The velocity of the wind exceeded 20 miles per hour A sinuous height of 40 feet was maintained throughout the one and a half times around the course—five miles—except when nearing the Casino, a summer opera house that juts out into the lake. This forms the "aeroplane graveyard" of the course. On Tuesday, December 14th, a trial in the field inside the race track was made The wind was blowing a gale of 30 miles an hour estimated velocity A start was made over ice, snow, and weeds of the infield. The machine got off the ground under these adverse conditions, but made a 100-foot flight only. A new carbureter had been put on the engine and a 4-bladed propeller substituted for the 2-bladed one. A bad spark plug gave trouble throughout the day. Later the machine was wheeled to the lake, and a start made from the ice. The aviator feared the demolishment of the machine, and held close to the surface A piercing northwest wind swept the ice, and during the two flights a speed of 62 miles per hour was made with the wind while flying near the west shore The timing was done by Mr J H Hess, and the distance was measured by your correspondent.

Wednesday was a day of failure, owing to motor trouble and unfavorable winds, until a late hour in the afternoon, when two trials were made over the field within the race track. The first was a very short flight, and the second resulted in breaking two support braces of the horizontal rudder The manager of the flights appointed by the Retail Merchants' Association insisted that the starts be made from the field within the race track This was an undulating surface covered with ice and snow, and only 1,250 feet long.

On Thursday, after the 2-bladed propeller had been replaced and the old carbureter reinstalled, the machine was taken to the lake once more A stiff north west gale delayed flight until late in the afternoon Two flights, or rather a series of short flights, were made. A circuit of the course was accomplished with numerous touches. Only three cylinders were firing part of the time, and at these intervals the machine touched the ice The motor finally failed altogether, and the machine was stopped so suddenly by the application of the brake that it skidded completely around on the ice This resulted in breaking the cement of the tires and almost ripping them off Later, when the second flight began, after covering 600 feet the motor started missing, and while passing through a snow drift two tires were thrown, locking one wheel, but notwithstanding this, the machine again rose and covered 1,000 feet The motor picked up in the meantime. Altogether, some remarkable feats were accomplished.

The flight on Sunday, December 12th, was discontinued owing to inability to see, the fast-falling snow having formed ice upon the aviator's goggles. This flight was made in private, and was not witnessed by many people

On Sunday, December 19th, aviator Hamilton made his longest and best flight at St. Joseph. He circled above Lake Contrary for twelve minutes. The flight was witnessed by 600 interested spectators

Correspondence.

SPEED OF THE "NORTH DAKOTA."

To the Editor of the SCIENTIFIC AMERICAN

Following closely on the heels of the article in the SCIENTIFIC AMERICAN giving the new U S. battleship "North Dakota" the proud title of "Fastest Dreadnought Afloat," there appears in the columns of a Canadian publication of the first class a statement to the effect that British "Dreadnoughts" are known to make an average of over 23 knots an hour, while the maximum average made by the "North Dakota" is below 22 knots an hour

If the exact figures relating to Great Britain's naval affairs are not very generally known, may it not be that she, perhaps more wisely, prefers not to publish to the world her naval secrets, while Americans, in justifiable pride over their achievements, are making ill-advised haste to claim the first place in the progress of naval science. We have a right to expect the perfection of accuracy in all matters treated of in the pages of the SCIENTIFIC AMERICAN M W

Stanstead, Quebec.

[The "Dreadnoughts" referred to as making over 23 knots are probably the cruiser-Dreadnoughts of the "Invincible" type The "North Dakota" is of another class.—ED]

EFFECT OF EARTH'S ROTATION ON GYROSCOPIC CARS.

To the Editor of the SCIENTIFIC AMERICAN

I take much pleasure in reading your paper, and being a railroad man, was especially interested in the article describing the monorail car I have seen the gyroscope principle, for balancing such a car, discussed numerous times, but there is one point regarding gyroscopes which I have never seen mentioned in connection with this scheme.

It may not be of much importance, but it is nevertheless interesting, to note that a gyroscope does not retain its balance relative to the earth, but relative to a fixed point in space In other words, it would appear that on a "mono-railroad" running north and south a car would be tilted to the west at the rate of fifteen degrees per hour, or one degree every four minutes, due to the rotation of the earth

Of course, this is not fast enough to inconvenience anything, and perhaps Mr Brennan has provided a way to overcome this difficulty, but if not, it would be interesting to hear what others have to say in regard to this.

At any rate, a solution of this problem would be more interesting and of more practical benefit than the computation of our ancestors For the monorail appears like a great improvement over the double-rail system for economical and rapid transportation In fact, for light, high-speed passenger and express traffic, it would seem as if there is a great future in store for the monorail. T E BAKER.

Lockwood, Ohio.

SAFETY IN MINES.

To the Editor of the SCIENTIFIC AMERICAN

I noticed in a recent issue of your valuable journal a suggestion for the better safeguarding of the lives of coal miners. As this suggestion was on the lines of ideas that I have for some time entertained, I would like to amend your suggestion by an addition

I believe that stations of refuge, provided with fire and gas-proof doors, should be established in various places in coal mines, and that these stations be provided with two tubes or casings driven from the surface by well-driving machinery This would allow an air, food, and water supply to be maintained indefinitely, whether or not it should be necessary to seal the mine for the purpose of extinguishing fires Of course, it would be necessary to equip each of these stations with telephone and possibly lighting facilities, and of course, with facilities for forcing air into one of the pipes.

I am assuming, without having made figures on the proposition, that sufficient air to supply a considerable number of men could be forced through a six-inch tube by sufficient pressure.

I believe it should be compulsory that mine operators should provide some stations which would prevent such appalling calamities as the recent one at Cherry, Ill., and with this or some similar plan the cost would be so slight that it would be practicable to carry the same into effect. ALEX. T BROWN

Syracuse, N. Y

EMERGENCY SHAFTS FOR MINES.

To the Editor of the SCIENTIFIC AMERICAN

As a further safety precaution in the operation of mines, I would suggest the drilling of large holes, as many as may be necessary, from the surface to the main arteries of the workings, up through which, in cases of disaster such as the recent one at Cherry, Ill, men could be drawn to safety. Seventeen-inch holes are now quite common in the oil country, and larger ones could be drilled if necessary. These holes could be located at different advantageous points, and terminate in rooms in the mines or alcoves cut at the sides of entries in such a location as to not interfere with their daily use Slings made of chains, four chains, 30 feet long, spaced equally around a circle the size of the hole, and attached to an iron ring or spider at their upper ends, five small circular platforms of strong wire mesh, spaced six feet apart, inside these chains, would make what could be termed a five-storied elevator cage that would haul five men or ten boys up at a trip.

Such a cage could be galvanized for durability, would be strong, and not weigh over 150 pounds. There could be handholds placed under each platform for the men to grasp to steady themselves These cages would collapse when they would strike the bottom and could be quickly loaded, a man stepping on to each platform as it would be slowly raised, and when loaded, could be quickly hoisted to the surface A perhaps better cage could be made of strong wire mesh, platforms and all but would have to be made to descend into a sump drilled deeper than the bottom of the mine, so that it could be loaded as it was raised.

The hoisting drum on the surface could be operated by steam, air, electric, or even horse power The latter would have been invaluable at Cherry, Ill, as there would have been ample time for even a slow-operating apparatus to have saved all able to get to it, but an electrically-driven hoister would be preferable to any other Wires from the power house could be run to each hoister, and proper inspection would insure the apparatus to be in working order, if it should be needed

Air could be blown down these holes for the supply of the men at the bottom, even if the cages were being used, the wire mesh construction of them allowing its passage Water, food, oil for light, etc, could be sent down through the holes, and even doctors with medicines

The holes could be left open at all times for ventilation, but if such would interfere with the working of the fan currents and other ventilation systems of mines, the holes could be kept closed at the top by a proper batten If water from the wells would drip down and interfere with the working of mines, the holes could be plugged at the bottom by means of an oil well packer or similar device which, while perfectly water tight, can be quickly removed, leaving the hole clear

I can see no reason why this plan of rescue in cases of mine disasters would not be entirely practicable and effective, even in mines of one thousand or more feet in depth. EDWARD ROWE

Indiana, Pa.

The Current Supplement.

An illustrated description of the large double-deck bridge which has been constructed over the River Wear to accommodate both railroad and highroad traffic is published in the current SUPPLEMENT, No. 1774 "A Log Box and How to Make It" is the title of an article which will undoubtedly be read with interest by amateur mechanics. Up to a few years ago water powers were easily bought for a song Nowadays they have so definite a value that the matter of ascertaining their actual horse-power is of considerable importance Mr W T Ryan explains how this calculation is made Robert M Strong's excellent comparison of gasoline and alcohol engines is continued The comet families of Saturn Uranus and Neptune are discussed by H C Wilson. L H Baekeland describes the use of his newly invented substance 'bakelite" for electrical and chemical purposes The kinetoscope has entered a new field It now shows us moving pictures of a world which is invisible to the naked eye and revealed only by the ultra microscope, all of which is explained in the current SUPPLEMENT James Scott writes on microscopic tree fungi The efficiency of modern aeroplanes is discussed by G Garnier on the basis of the results obtained at Rheims

A Correction.

In an article on page 462 of the SCIENTIFIC AMERICAN of December 18th, 1909 it is stated that by the interposition of a turbine between the low-pressure cylinders and the condenser of the cross-compound reciprocating engines in the 59th Street power station an additional 8,000 horse-power was secured The item should have read an additional 8,000 kilowatts. The maximum economical output of these engines is now 8,000 kilowatts developed in the reciprocating element and an additional 8,000 kilowatts in the turbine making a total of 16,000 kilowatts or say about 22,000 horse-power for the whole engine

The Municipal Art Commission of New York has just published a catalogue of the works of art belonging to the city of New York It is a book of 240 pages, and contains more than 100 illustrations reproducing the works of art scattered around the city

THE GREAT ST. BERNARD HOSPICE

BY HAROLD J. SHEPSTONE.

The St. Bernard Hospice stands some 8,120 feet above the level of the sea on a mountain pass which forms one of the principal highways between Switzerland and Italy. Over 20,000 persons cross this road every year, and as nearly two-thirds of this number accomplish the journey in winter, the monks and dogs of the hospice, whose mission it is to aid these travelers, may be said to be responsible for many lives every year.

The hospice can claim to be one of the oldest institutions in Europe. It was founded as far back as 962 by Bernard de Menthon for the benefit of pilgrims journeying to Rome. For many years after it was first erected it was subjected to frequent attacks by bands of mountain robbers. Often the brave monks were forced to barricade themselves in their stronghold until stress of weather drove the besiegers away. Once the hospice was destroyed by fire. Here Napoleon was received when he took his army over the Alps into Italy in the spring of 1800. His forces numbered 30,000 men, and for miles they had literally to fight their way foot by foot up the steep mountain pass, often waist deep in snow. Napoleon converted the hospice into barracks; the great guest room where travelers are now sheltered into a huge hospital ward.

When first seen the monastery from an architectural point of view is disappointing. It consists of a plain block of gray buildings with massive walls built to resist the wind and the weight of snow. In midwinter the snow around the buildings is seven to ten feet deep, and sometimes forms drifts against the edifice that reach right up to the roof. If the exterior is disappointing, the same cannot be said of the interior. On the side reserved for the better class of travelers there is a spacious dining room containing a handsome piano presented to the monks by King Edward, while the bedrooms with their spotless curtained beds are the essence of comfort. Anyone crossing the pass is at perfect liberty to enter the hospice and accept its hospitality. No traveler is ever turned away. Two good meals are served every day, namely at 12 noon and at 6 P. M. At these meals representatives of almost every nation on earth may be seen. Italians naturally predominate. Next come Swiss, then Russians, Germans, French, Turks, Spaniards, English, and perhaps two or three American travelers. The food is plain but good and plentiful, and the beverage served is the famous red wine of Piedmont. After meals travelers spend their time much as they wish, in easy conversation with one another, in games, in reading the books in the library, or in inspecting the curios in the museum.

Looking for bodies in the snow after an avalanche.

Not so long ago the hospice was put into telephonic communication with the outside world, with the result that the work of the monks has been lightened and that the number of lives lost has been reduced to a minimum. The monastery is connected by telephone

St. Bernard dog with flagon of wine.

with a small inn on the Swiss side and with St. Remy on the Italian side. At both these stations arrangements are made by which the monastery is warned of the number of persons that commence the ascent from these two places. Through these advices the monks know exactly how many travelers are making the ascent from either side of the mountain. It is really impossible for anyone to attempt to make the ascent without the monastery being warned. Often a party of travelers set out for the hospice in fine weather. A few hours later a sudden storm comes on, and the monks, knowing at what time the ascent was begun, know approximately what spot the travelers should have reached. At the hospice a book is kept recording the telephone messages, and also the number of travelers that reach the summit, so

that at any given moment the monks know the exact number of people on the pass and their approximate whereabouts.

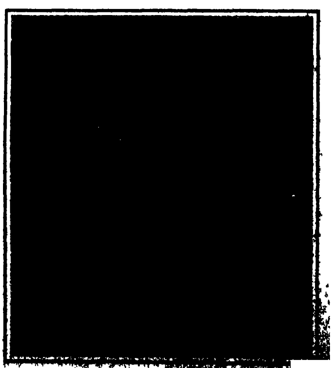
Only a few weeks ago a message was received on the telephone that three men, two women, and one child had started up the path. The weather was unsettled at the time, and two hours later a blinding snowstorm came on. At once two of the brethren accompanied by two dogs hastened down the pass to look for the travelers and guide them to the hospice. They knew about where the travelers should be, and were surprised that the dogs failed to scent them. After nearly two hours of fruitless search a dog arrived from the monastery. He carried a message to the effect that after they had left, a telephone message had been received saying that the travelers had returned to the inn.

When speaking about the dogs, M. Bourgeois, the present provost, and his principal assistant, Father Jules Darbellay, to whom I am indebted for the information contained in this article, assured me that the wonderful stories that have been told about the sagacity of the dogs are not exaggerated. Near the hospice is a monument to Barry. This dog saved forty lives in a period of ten years and then was accidentally killed.

In the kennels at the hospice there are at the present time fifteen trained dogs and an equal number of bitches and young puppies. They were all born at the monastery. Their training is very simple. During the summer months, when the monks are not so busy, they take the young dogs out in the valleys or hollows where there is always snow. One man then lies down in the snow or buries himself in it. A dog is sent to look for him. He is taught to bark when he has found the man, and also to rouse him up from sleep by licking his face. When the man wakes up and stands on his feet the dog leads him to the hospice, running on in front to show him the way.

According to the traditions of the monastery, the St. Bernard is a cross between a Danish bull bitch and a mastiff, a native hill dog, though at what time the cross was effected it is impossible to say. After the breed was once established it was kept pure until 1812, when, owing to the severity of the winter, the monks were obliged, contrary to their usual custom, to send out the brood bitches as well as the dogs, with the result that all the females succumbed to the cold, and the monks found themselves without the means of continuing the pure breed. In this extremity a cross with the Newfoundland was tried, but at first failed owing to the excessive coat of the Newfoundland, which hampered the dogs in the snow; however, by breeding back to their own short-coated dogs, the

The interior of the chapel.



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THE GREAT ST. BERNARD HOSPICE.

monks obtained the desired shortness of coat, though occasionally specimens were born with the rough coats These rough-coated animals were sold or given away to the inhabitants of the surrounding valleys, who continued to breed them so that St. Bernard dogs soon became general in Switzerland. The full grown specimens in the kennels at the hospice are magnificent creatures of their kind They stand thirty inches high at the shoulder and weigh about one hundred and fifty pounds. They are exceedingly strong and can carry a man for a considerable distance By nature they are gentle except in the puppy season when the mothers are apt to resent attentions.

This band of faithful creatures commence their work in earnest at the end of September and continue looking for lost travelers right on to the middle of June which period represents the winter season on the pass In the depth of winter not a vestige of a path is visible The snow drifts too present formidable obstacles Besides there is the danger of avalanches Fogs are frequent and in stormy weather the wind rises to a hurricane blowing the snow into one s eyes and making it impossible to see any distance ahead.

Great St. Bernard hospice in winter Such snowdrifts are not extraordinary in the Alps.

Entrance to the St. Bernard hospice

Indeed the monks will not hesitate to tell you that during the winter months it is impossible for an inexperienced traveler to venture upon the mountain and safely negotiate the pass without receiving help

Considering the perils of the road one may well ask why people venture upon it during the winter The fact is the greater majority are poor workmen going or returning from their labors on the other side of the Alps In February and March as many as a hundred will make their way across the pass in a single day It is then that the monks are busy They think nothing of remaining out in the snow seeking the lost, for twenty four hours at a time Father Darbellay told me that he has known the dogs to remain out in the snow for two days eating very little and not taking any rest or sleep

Before the advent of the telephone the dogs carried a flagon of wine tied to their collars and food strapped to a saddle on their backs. Now they carry only the wine because it has been found that the weight hinders their progress through the snow So well are they trained, that they are often dispatched by themselves down the pass to escort travelers up the treacherous path to the hospice They always discover them and guide them to the desired haven. In the same way the monks will allow the dogs to accompany the travelers on their journey down the mountain if the weather is at all bad and the road difficult to trace If a traveler is found in an exhausted condition he is conveyed to the monastery on an improvised stretcher Should it prove that help has arrived too late the body is left strapped to the board and placed in an upright position in the mortuary chapel by far the most gruesome place in the whole monastery Through the low latticed bars of the windows one can gaze at the dead within The keen air sweeping from end to end preserves these poor relics of humanity for years in a semi mummified condition, and unless they are identified there they remain. At the present time there are some twenty bodies in the morgue, one of which is said to have [illegible] years.

[illegible]

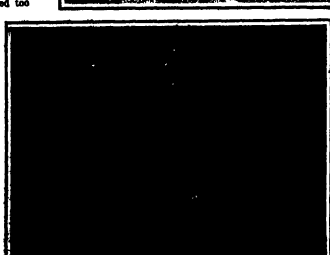
ions There are over one hundred beds for travelers and they are never empty during the winter months Of [illegible] the monks are called upon to find shelter for as many as three hundred or four hundred persons at one time No one is asked to pay for his accommodation Very few drop into the alms box in the beautiful chapel the amount that would have been paid for similar accommodation at an ordinary hotel Hence the monastery must depend to a very large extent upon other means of support Unfortunately too the expenses are very heavy for almost all supplies have to come from Aosta and the neighboring villages The monks have a deep cellar where they keep their wines unfrozen Fresh meat is procured from the valleys in summer but for the winter the priests lay up a store of salted meat They also keep a number of cows in the summer to supply them with milk butter and cheese but only one cow is retained in the winter Wood for firing is one of the most important necessaries Not a stick grows within seven miles and all the fuel has to be brought from a forest on the banks of horses For this purpose alone about thirty horses are employed daily during the brief summer

The following notes concerning the storage of California or crude oil in concrete reservoirs were recently given in Concrete A 1 000 000 barrel reservoir lined with concrete has recently been completed at Port Richmond Cal and one of 800 000 barrel capacity is under construction near Bakersfield The practice is to excavate the earth which in most fields is a sandy loam porous and very dry to about one third the depth of the proposed reservoir With the material removed a levee is built round the excavation having side slopes of

Training a dog with dummies to discover a lost traveler

1 1½ on both faces The bottom and sides are then covered with about 3 inches of concrete often reinforced with expanded metal or some equivalent Small cracks that occur at the junction of the sides and bottom and along the line between the cut and the embankment soon become filled with sediment and are believed to permit the leakage of very little oil

A number of such structures in Southern California have recently been examined and no signs of depreciation in the quality of the concrete were found even in those which had been in use for a considerable period



Young dogs in the snow

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THE HEAVENS IN JANUARY

BY HENRY NORRIS RUSSELL, PH D

As we watch the brighter stars on a clear winter's night we may well be impressed with the notable differences in color among them What may strike us first is that a very bright star like Sirius when low on the horizon visibly changes color from moment to moment This is like its twinkling purely an effect of our atmosphere whose refraction changing slightly as masses of air of different density are carried across our line of sight by the wind causes now one color now another to be strengthened for an instant in its spectrum while others may be for a moment almost absent

But when the stars have risen high and the night is clear and calm so that these disturbances are no longer perceptible the differences of color persist

Sirius is brilliantly white and so are most of the stars of Orion Capella (whose light much resembles that of our sun) is clearly yellow Aldebaran is orange red and Betelgeux redder still The fainter stars whose light is too weak to show much color to the naked eye when examined with the telescope show similar differences in hue

The cause of these phenomena so easily observable must be sought in the stars themselves Recent physical research has made it almost certain that we may find it in their temperature

If we take a solid body such as the carbon filament of an incandescent lamp and heat it up gradually to higher and higher temperatures which in this case we may easily do by increasing the electric current—we will observe that when it first becomes visible its light is of a dull red As the current is increased the light becomes very much brighter and yellow instead of red

If finally we apply a very high voltage and put through the lamp a heavy current which it can stand only a short time without breaking down it will give for the moment an intense white light far whiter as well as far brighter than under ordinary conditions

All incandescent solids or liquids behave in the same way and careful work both in the laboratory and on theoretical lines has led to a formula (too complicated to be given here) which enables us to tell just how much light of any given color (or wave length) will be given off per square inch of surface at a given temperature We cannot of course experiment with temperatures as high as those that prevail upon the sun but there are good reasons to suppose that the formula fits the facts very closely even in this case

We may illustrate its results by an example Consider a star of the same temperature as the sun and suppose that we observe it (1) through deep red glass which transmits only the extreme red rays (2) through a yellow glass transmitting only the yellow and green light (3) by photography when the violet rays are alone effective Now suppose its temperature suddenly doubled Our formula tells us that through the red glass it will look about seven times as bright as before through the yellow glass more than ten times and by photography some twenty times as bright

If on the other hand its temperature was reduced to half its initial value its light would fall off much more rapidly the red to 1/40 the yellow to 1/100 and the blue to but 1/400 of its original amount

Suppose now that we had three stars close together in the sky whose surfaces were at the three temperatures just discussed Which of them will look brightest to us will depend on how big they are and how far away Let us suppose that, viewed through the yellow glass, they all seem equal in brightness, in which case the hottest one must of course be much smaller or much more remote, than the coldest.

From the numbers just given we can deduce that, when seen through the red glass the hottest star will seem but 70 per cent as bright as the one which resembles the sun and the coldest star twice as bright as this standard of comparison. On the photograph the disparity will be even more marked The hot star will appear twice as bright and the cold star only one-quarter as bright as the one of the solar type

We have thus a means of determining their temperatures even though we do not know how far off they are nor what is their actual brightness by comparing their relative brightness in light of different colors

An extensive series of observations of this sort have recently been made at Potsdam by Scheiner and Wilsing using apparatus of high precision and great care to avoid all sources of error and employing five different colors of light so that the comparison of the values obtained from them might serve as a check not only upon the accuracy of the observations but of the formula used in calculation

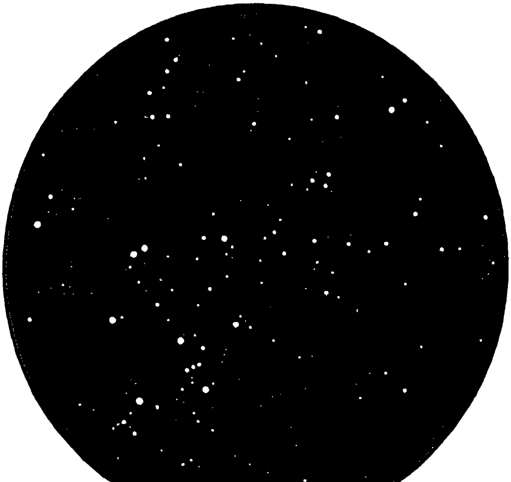
The results are highly satisfactory and form an important contribution to our knowledge of the stars

As is obviously to be expected from what has been said the white stars are the hottest The average temperature of those observed comes out about 11 500 deg C just about double that of the sun

The average temperature which they calculate for a number of stars whose spectra resemble the sun's is 5900 deg—a little higher than that of the sun itself That of the stars which resemble Arcturus in spectrum is 4200 deg and that of the reddest stars like Betelgeux about 3300 deg—lower than that of the carbons in the electric arc (The arc light of course looks far bluer than most stars but this is because much of its light comes from hot carbon vapor which like the mercury vapor in the now familiar lamps gives off strongly colored light of its own in this case violet)

A rather faint telescopic comet was discovered by Mr Daniel at Princeton on the night of December 6th It was then about fifty million miles from us and very close to perihelion It is now slowly receding from earth and sun but will remain telescopically visible until the end of January or later

Halley's comet though well placed in the evening sky in Pisces not far from Mars and Saturn will probably still be much too faint to see without a telescope



At 11 o'clock Dec 7
At 10½ o'clock Dec 15
At 10 o'clock Dec. 22.

At 9 o'clock Jan 7
At 8½ o'clock Jan 14
At 8 o'clock Jan 22.

At 9½ o'clock December 30

NIGHT SKY: DECEMBER AND JANUARY

THE HEAVENS

The finest region in the starry sky is now well seen in the southeast. High up, almost overhead, is Taurus, marked by the group of the Pleiades and the red Aldebaran. Below is the splendid Orion, and beneath him Canis Major with the incomparable Sirius.

East of the zenith is Auriga with the great golden star Capella. Below are the Twins, and on the right Procyon The faint star cluster Praesepe marks the place of Cancer and on the horizon are Hydra and Leo partly risen

The constellations in the southwest are much less prominent. Aries which is high up can at once be recognized by the peculiar small triangle formed by its three principal stars the faintest of which γ is a fine double Our initial shows how ridiculously little resemblance there is between the figure of the Ram and the stars which bear his name

Eridanus Cetus and Pisces are none of them very bright but the planets Mars and Saturn which are close together in the last are conspicuous. The very brilliant object in the southwest early in the evening is the planet Venus.

Pegasus and Andromeda are well seen in the west Perseus is right overhead and Cassiopeia Cepheus and Cygnus occupy the Milky Way as far as the northwestern horizon Ursa Major and Draco are under the pole and Ursa Major is coming up in the northeast.

THE PLANETS

Mercury is evening star until the 26th when he passes between us and the sun and becomes a morning star He is well visible during the first half of the month especially about the 10th when he sets about 6 15 P M He is then in Capricornus far from any bright star and should be easily identified

Venus is exceedingly bright and conspicuous especially at the beginning of the month when she sets about 8 10 P M By the end of the month she has come nearly into line between us and the sun and is less prominent setting about 7 P M but is still far brighter than anything else in sight

Mars is in Pisces at the beginning of the month close to Saturn and gradually moves eastward into Aries He is in quadrature with the sun on the 17th and is on the meridian at 6 P M Viewed telescopically he shows a marked gibbous phase—like the moon three days from full

Jupiter is in Virgo and rises about midnight being in quadrature with the sun on the opposite side from Mars on the 4th Saturn is almost opposite him in the sky in Pisces and is visible in the evening almost till midnight

Uranus is in conjunction with the sun on the 11th and is invisible throughout the month Neptune is in opposition on the 8th and is visible all night long He is then in R A. 7 h 17 m 28 s declination 21 deg 22 min N and is moving 7 1 s to the west and 14 sec. northward daily His motion alone serves to distinguish him from the stars unless one has a telescope powerful enough to show his disk

THE MOON

Last quarter occurs at 8 A M on the 3d new moon at 7 A M on the 11th first quarter at 5 A. M on the 18th and full moon at 7 A M on the 25th. The moon is nearest us on the 17th, and farthest off on the 4th and 31st.

She is in conjunction with Jupiter on the 3d Uranus on the 11th Mercury on the afternoon of the 12th, Venus on the 13th Saturn on the 17th Mars on the 18th, and Jupiter once more on the 30th.

Princeton University Observatory

The memory of the late Capt. Charles W Gridley, who was Admiral Dewey's flag officer on board the cruiser Olympia at the battle of Manila Bay in 1898, has been honored by a bronze memorial tablet which has been placed on the wall of Memorial Room in Bancroft Hall Annapolis, Md. The funds were procured by popular subscription

THE RIGNOUX-FOURNIER SYSTEM OF TELEVISION

BY FERNAND HONORÉ

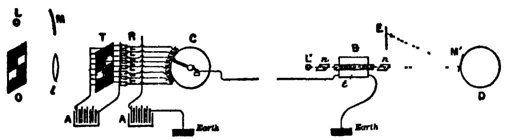
In the present state of science, the solution of the problem of vision at a distance by means of electrical transmission appears to be only a question of money Researches in this field are directed toward the utilization of a peculiar property of the element selenium, which conducts electricity more or less readily in proportion to the intensity of the light which falls upon it Upon this property is based the system of electrical transmission of photographs which was invented by Prof. Korn, of Munich, and which has for several months been in regular operation between the offices of the Daily Mirror in London and L Illustration in Paris The general arrangement of Korn s apparatus has already been described in the Scientific American The photograph to be transmitted a negative film, is wrapped round a cylinder which is caused to rotate before a source of light so arranged that only a very small area of the photograph is illuminated at a time The pencil of light after traversing the film falls upon a cell of selenium forming part of an electrical circuit which extends to the receiving station Owing to the property of selenium mentioned above the current which flows through this selenium cell at any instant is proportional to the transparency of the negative film at the point traversed by the pencil of light at that instant At the receiving station this fluctuating current is employed to uncover to an extent proportional to the instantaneous strength of the current a lens which conveys a beam of light upon a photographic film carried by a cylinder which rotates in synchronism with the cylinder at the transmitting station Hence the part of the film on which the beam falls is illuminated and consequently blackened to a degree proportional to the transparency of the corresponding part of the original film In short a negative at one station produces a positive picture at the other by the successive transmission of many small parts

Instead of prolonging the operation in this manner let us suppose that it is all done at once Let us project the image upon a sheet of selenium divided into a very large number of small cells each of which is connected with the receiving station by a separate wire It is evident that in this way the entire picture could be transmitted at once and consequently that electrical vision at a distance could be realized But in order to accomplish this thousands of wires each connected with appropriate apparatus, would be required and the expense incurred would probably be out of all proportion to the value of the results obtained

This theoretical scheme has not formed the basis of any practical experiments which have yet been brought to public notice It was announced a few months ago that E Ruhmer the well known electrician of Berlin had solved the problem and that his apparatus costing an enormous sum to construct would be the principal attraction at the Exposition at Brussels in 1910 No details of the apparatus however have been published We know that it employs selenium but we do not know whether it uses one wire or many wires

In this state of the problem it seems particularly interesting to note the solution proposed by two French inventors M Rignoux and Prof Fournier some of whose experiments the writer has had the good fortune to witness

Rignoux and Fournier have invented two types of apparatus The first is designed merely for demonstration and necessitates the employment of many wires It may be described briefly as follows At the transmitting station an object (a large letter of the alphabet for example) is strongly illuminated and its image is projected by a lens upon a frame containing a number of selenium cells each of which is connected with the receiving station by a separate wire Each cell, and its wire, transmits a current proportional to the brightness of the part of the image projected on that cell and the corresponding part of the object At the receiving station these simultaneous currents of unequal intensity traverse an equal number of little coils, and thereby uncover the same number of little mirrors to an extent proportional to the strengths of the various currents Beams of light reflected by these mirrors are projected on a screen, side by side, forming patches of various degrees of brightness, proportional to that of the corresponding parts of the object With a very large number of selenium cells, wires, coils, and mirrors it would be possible to transmit a picture with fine detail and many gradations of tone. The experimental demonstration, which is actually made is summary and crude, but quite convincing The multiplicity of wires is a serious defect, which the inventors believe they have found means of remedying in their second apparatus which is in course of construction and is illustrated by the accompanying diagram At the transmitting station the rays of the luminous source L are reflected by the mirror M upon the object O the image of which is projected by the lens l upon the frame of selenium cells T (The diagram shows a frame of eight cells and an object divided into eight equal squares Two of the squares are white and their images illuminate the two corresponding selenium cells) The very weak currents transmitted by the selenium cells are sent into the relay R where they set into motion much stronger currents, the intensities of



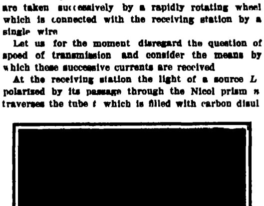
THE RIGNOUX FOURNIER SYSTEM OF TELEVISION

which are proportional to those of the selenium cell currents to the illumination of the respective cells and to the brightness of the corresponding parts of the object

The problem is to transmit all of these currents through a single wire without confusion and to receive them and cause them to act separately and simultaneously at the receiving station For this purpose Rignoux and Fournier have devised the following arrangement The currents are conveyed to the contact pieces of the collector C from which they are taken successively by a rapidly rotating wheel which is connected with the receiving station by a single wire

Let us for the moment disregard the question of speed of transmission and consider the means by which these successive currents are received

At the receiving station the light of a source L polarized by its passage through the Nicol prism n traverses the tube t which is filled with carbon disulphide, and then falls upon a second Nicol prism n', which is crossed with regard to the first prism The tube is surrounded by a coil of wire B which is connected with the wire coming from the transmitting station Hence the currents which traverse the selenium cells for the transmitter flow successively through this coil and produce an electro-magnetic rotation of the plane of polarization of the light which is passing through the carbon disulphide to a degree proportional to the illumination of the particular selenium cell which is momentarily connected with the line wire causing corresponding fluctuations in the intensity of the light which emerges from the second Nicol prism n' This beam of light of varying intensity falls upon the cylinder D which rotates in synchronism with the collector C at the transmitting station, and which carries a number of mirrors M', equal to the number of selenium cells Hence each mirror reflects a quantity of light proportional to the illumination of a particular selenium cell and the brightness of the corresponding part of the object. The mirrors are so arranged that the light reflected by each falls on a different part of the screen E on which is thus produced a mosaic picture formed of patches of various degrees of brightness of the object exposed at the transmitting station



The New President of the American Association for the Advancement of Science

It is possible to transmit and make visible in this manner employing a single wire an image produced by several thousands of selenium cells? Yes There is no difficulty in constructing a frame of 10 000 or more selenium cells each connected by a separate wire with a collector which comprises an equally large number of contacts Now if we remember that the frequency of alternation of an alternating current often exceeds 100 000 cycles per second it becomes evident that 10 000 currents can be collected and transmitted successively over a single wire in a small fraction of a second By the employment of 10 000 mirrors at the receiving station an image composed of 10 000 patches of light can be projected within the same fraction of a second The different parts of the picture will really be projected successively but they will appear to be simultaneous owing to the persistence of impressions on the retina of the eye If the projection of the entire picture is accomplished within 1/40 second and the apparatus can be so constructed that this process will be repeated indefinitely giving the appearance of a persistent picture instead of a fleeting glimpse

Hitherto we have supposed the number of mirrors to be equal to the number of selenium cells It may be found possible however to diminish the number of mirrors and to operate each mirror successively by the currents from several cells This modification would doubtless involve complications and difficulties in construction which we need not discuss For the present it suffices to show that the problem of vision at a distance by means of a single wire connecting the two stations has been solved by MM Rignoux and Fournier In the practical realization of the desired result the inventors will have to reckon with the phenomena of self induction interference and the electric inertia of selenium but these are familiar technical difficulties which will sooner or later be surmounted

DAVID STARR JORDAN

BY MARCUS BENJAMIN PH D

The distinction of studying natural history under Louis Agassiz in the laboratories in Cambridge is one to be highly appreciated and of the many eminent naturalists who were so fortunate as to receive their first inspiration under the guidance of that renowned master many if not most have ceased their activities Of the earlier students Brooks Hyatt and Packard have joined the silent majority Alexander Agassiz Putnam Scudder and Verrill are fortunately still with us in the happy possession of an assured fame At the close of the elder Agassiz s career he established a summer school on Penikese Island and of those who studied there two have achieved especial distinction Richard Rathbun the Assistant Secretary of the Smithsonian Institution who is now directing the activities of a score or more of younger men in the work of the National Museum and David Starr Jordan who presides over the destinies of the great Stanford University in California Prof Jordan has been called to preside over the meeting of the American Association to be held this week in Boston and of him is the following brief sketch

David Starr Jordan was born in Gainesville New York on January 19th 1851 and grew up on his father s farm in Wyoming County receiving his early education in schools in the vicinity of his home In 1868 he entered Cornell and there devoted himself to scientific studies developing a special interest in botany in which branch he was made instructor in his junior year and continued to hold that place until he was graduated with the degree of M S in 1872

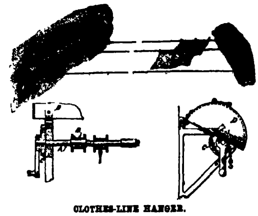
He was called to the chair of natural history in Lombard University in 1872 a place which he held for a year and then accepted the principalship of the Appleton (Wis) Collegiate Institute He then entered the Anderson School on Penikese Island as a student and lectured there on marine botany during the summer of 1874 It was there that he came under the influence of the elder Agassiz and began his studies

(Continued on page 16)

Patent Department

CLOTHES-LINE HANGER.

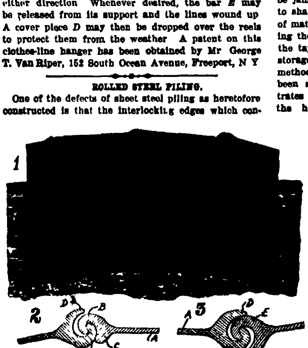
The clothes-line hanger which is illustrated in the accompanying engraving is adapted to support a number of clothes lines at the same time, and yet permits of taking up the slack of the lines individually or altogether when desired The lines are attached at one end to a fixed support, while the other ends are connected to separate reels, all of which are mounted on a single shaft that may be wound up to stretch the lines taut. The shaft, which is indicated at *A*, is provided at intervals with square sections adapted to fit the square bores of the reels *B* The shaft is mounted in suitable brackets attached to a wall, and at each end is provided with a ratchet and a crank, so that it may be wound up to tighten the lines. Each line is provided with a hook at one end adapted to engage a corresponding eye in the bar *E*, which is made fast to an opposite wall or other support. Whenever it is desired to take in one of the lines, or to tighten it or loosen it with respect to the others, the reel on which it is wound is moved axially until it clears the squared section of the shaft *A*, and is then free to be turned in either direction Whenever desired, the bar *E* may be released from its support and the lines wound up A cover piece *D* may then be dropped over the reels to protect them from the weather A patent on this clothes-line hanger has been obtained by Mr George T. Van Riper, 152 South Ocean Avenue, Freeport, N Y



CLOTHES-LINE HANGER.

ROLLED STEEL PILING.

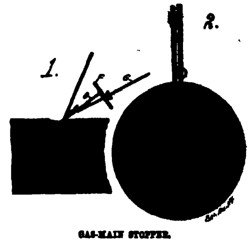
One of the defects of sheet steel piling as heretofore constructed is that the interlocking edges which connect one pile with another are apt to spread open when the piles are under strain. Pictured herewith is a new form of sheet piling with strong flexible joints, so constructed as to oppose spreading strains at the various positions which the piles may assume with relation to each other. Fig. 1 shows a set of piles driven in a curved row. Details of the interlocking parts are given in the sectional views, which show two different forms of piles. Each pile consists of a web *A*, furnished with a pair of flanges formed to interlock with the flanges of the next adjacent pile. In the construction shown in Fig. 2, the right and left-hand ends of the pile differ in design. The left-hand end has a wide tapering flange *B*, that is bent to the form of a hook, and a short, slightly curved flange *C*. The right end of the pile is somewhat similar in form, the flange *E* being curved to approximately the same form as flange *B*, but the flange *D* is considerably longer than the flange *C* Fig. 2 shows a preferred construction. The interlocking parts are of the same design, except that they are made in right and left-hand forms. With either design the interlocking flanges will rigidly be retained under pulling strains at whatever position the parts may assume. The piles are of simple construction, and may readily be rolled in rolls of proper design. The inventor of this piling is Mr William Neilson, of 1379 Montezuma Street, Pittsburg, Pa.



ROLLED STEEL PILING.

GAS-MAIN STOPPER.

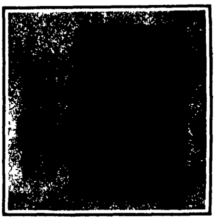
A novel form of gas-main stopper is illustrated in the accompanying engraving. It consists of a flexible diaphragm mounted on a collapsible spring frame, which may be expanded in the gas main by exerting pressure at two diametrically opposite points. The spring frame is indicated at *A* in the illustration, and when in collapsed condition is elliptical or oval in form. The diaphragm attached to the frame is shown at *B* Connecting opposite extremities of the oval shaped spring frame *A* are a pair of telescoping members *C*, to which the operating handles *D* and *E* are attached. It will be evident that when the handle *E* is drawn upward and handle *D* pressed downward, the member *C* will telescope, drawing the frame *A* into circular form In order to provide for operating both of the handle bars simultaneously, a crosshead *F* is fitted to the outer end of the bar *D*, and is provided with an aperture through which a threaded bar *G* is adapted to pass The bar *G* terminates in a hook, which engages a link secured to the bar *E*, and a thumb nut threaded on the bar *G* and bearing against the crosshead *F* serves to draw the bar *E* outward, and at the same time to press the bar *D* inward, so as to press the stopper into the circular form In use the stopper is introduced into the gas main through an opening, and inclined with its lower end extending toward the end from which the gas is flowing. The operating bars project through the opening, and when the thumb nut is tightened the frame is brought to a nearly vertical position, as indicated in the drawing, thus lying crosswise of the main and effectually stopping the flow of gas. The inventor of this improved gas-main stopper is Mr Patrick Goodman of 257 East 133rd Street, New York city



GAS-MAIN STOPPER.

A NOVEL METHOD OF COOPERING CASKS.

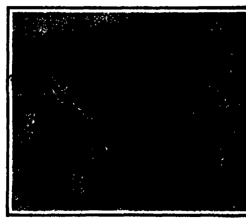
It is customary to build casks with tapering sides, so that the hoops which bind the staves together may be jammed tightly in place. This makes it necessary to shape the staves, which entails considerable waste of material and much trouble in assembling and bending them into position. Another disadvantage is that the tapering or bulging cask requires more room for storage than if made truly cylindrical A novel method of overcoming these difficulties has recently been suggested. The accompanying engraving illustrates this method. Between the staves and the hoops rings are placed, which are tapered as indicated in the sectional view, Fig. 2. When the rings are driven down they act as wedges to jam the hoops tightly, so as to bind the staves in place. In order that the ring may contract in diameter as it is wedged into place, it is made of wire or a strip of metal that is crinkled or bent into a zigzag form. This lightens the construction, and provides a better grip on the hoops and staves. In many trades small kegs and casks of moderate size for liquids are required, but their high price and the cost of machinery for making them is prohibitive for many purposes. The casks here described are especially suited to meet the requirements of such trades, because after the staves and heads are prepared they can be finished inside and out (including cutting the grooves) in an ordinary lathe, producing an inexpensive cask of attractive and finished appearance. The inventor of this novel construction is Mr. William Houlker of Nelson, New Zealand.



A NOVEL METHOD OF COOPERING CASKS.

AREA-FINDING APPARATUS.

A very unique method of finding the area of surfaces with irregular boundaries is pictured in the accompanying engraving. It comprises a flat steel plate that is magnetized, and hence becomes a permanent magnet, and a number of soft iron balls. The size of the plate depends upon the dimensions of the area to be measured. The drawing on which the area is outlined is placed over the plate, and to protect the drawing a thin piece of paper is placed over it. The area outlined is then filled with the iron balls, which are flat on the under side to prevent them from rolling. The magnetised plate converts the balls into temporary magnets, causing them to cling to the plate and to each other. After the area of the drawing is filled, the balls are taken out and placed in a measuring frame, as indicated in the engraving, and the number of square inches occupied by the balls is ascertained. Tables are furnished which permit of reducing the square inches thus found to the scale of the drawing, thus giving the area sought without any calculation. It will be observed that the side members of the measuring frame are calibrated, and the sliding cross-bar is provided with vernier scales, so that the area occupied by the balls may be obtained with exactitude. The ease with which any given area can be set on first trial should make this apparatus valuable to engineers and surveyors. The apparatus is adaptable to irregular as well as regular surfaces. The inventor of the area finder is Mr Alfred C Freeman of Norfolk, Va.

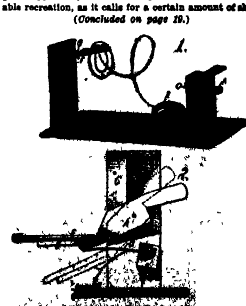


AREA-FINDING APPARATUS.

A NEW GAME.

Pictured in the accompanying engraving is a novel game apparatus, which is adapted to afford considerable recreation, as it calls for a certain amount of skill.

(*Concluded on page 19.*)



A NEW GAME.

RECENTLY PATENTED INVENTIONS.

Heating and Lighting.

MINER'S LAMP.—R. L. Graves, Sumpter, Ore. The present invention is an improvement on the two former patents granted to Mr Graves. In both the inventions covered by the above patents, the lamp is provided with means connected with the wick-tube, for heating and liquifying paraffin or other solid hydrocarbon, whereby it may be taken up by the wick and burned for illumination. In both, heat-conducting wires are used in connection with the wick proper, the same being extended alongside the wick and down into the body of the lamp

AUTOMATIC CUT-OFF FOR GAS-MAINS.—C. M. Lammers, New Philadelphia, Ohio. The invention refers to devices for preventing explosions or accidents caused by changes in the pressure in gas mains. An object is to provide a device which will automatically shut off the flow of gas from the mains when the pressure therein becomes too low, thereby preventing the accidents which might otherwise occur

DRILL-GUIDE.—A C Neal, New York, N Y. The object of this improvement is to provide a device easily adjusted and inexpensive to manufacture. The invention relates to a device to be used to guide a drill in the twyers of a blast furnace when it is desired to remove the crusts or slag which have formed over the opening of the twyer. Mr Neal has invented another drill-guide, and his object is to prevent accidents to the drill-guide on back strokes of the drill. In other words, he provides a construction for holding the inner guide member loosely in position and in such a way that if struck by the head of the drill bit the blow will be cushioned.

SAFETY GAS CUT-OFF.—H Tullis, Lisbon, Ohio. The aim in view in this case is to provide a mechanism for cutting off the supply of gas in the event of the same being inadvertently or otherwise temporarily suspended. A great deal of disaster and discomfort has been experienced in the past, due to the accidental or intentional suspension of gas service in buildings and renewal of the same after the light has become extinguished, due to suspension. To avoid this danger the mechanism has been invented.

LAMP.—Henry Salsbury, 124 Long Acre, London, England. The invention is especially applicable to lamps such as used in conjunction with motor vehicles. By providing suitable surfaces within the lens of the lamp, the rays of light which would be otherwise projected upward and produce glaring in the eyes of one approaching, are reflected downward and the beam of light emitted from the lamp restricted to a level below that of the line of vision of the observer. The glaring is especially noticeable in connection with acetylene lamps.

HOT-AIR FURNACE.—W Miller, New York, N. Y. In the present patent the purpose of the inventor is the provision of a new and improved hot-air furnace, which is arranged to insure a rapid circulation and thorough heating of the air, and at the same time utilizing the burning fuel to the fullest advantage.

Household Utilities.

CHAIR.—W P Lawrence, Colorado Springs, Colo. The invention has reference to certain improvements in metal chairs, the main object of the inventor being to construct a chair, the principal portions of which are formed of sheet metal and all the parts of which are so connected together that all rivets, bolts or other fastening means are concealed from view

WASHING-MACHINE.—E. Banthun, Kewaskum, and C J Gutekunst, Campbellsport, Wis. The purpose here is to provide a washing-machine of the pounder type, which is simple and inexpensive and that may be operated by hand or other power, and which will rapidly and perfectly cleanse garments or other fabric that is operated upon by the machine.

ARM-CHAIR AND FOLDING BED.—J C. Smith, Manchester, N H. The invention pertains to furniture, and the object is to produce a chair which can be readily converted into a bedstead. When the chair body is seated on the leg frame, the sides of the chair body fold over and around the foot section so that the latter operates to hold the chair in position.

ATTACHMENT FOR BEDS.—P H Wilson, Talent, Ore. The aim of the invention is to provide a bed having a stretcher disposed over the mattress with means for drawing the stretcher taut, a continuous belt having a surface disposed over the stretcher, the belt being disposed on drums at the head and foot of the bed respectively, there being means provided for rotating the drums.

Machines and Mechanical Devices.

REVERSING MECHANISM FOR THE BAND-CYLINDERS OF SPINNING-MULES.—J. H. [illegible], Charlottesville, Va. The improvement in this instance is in reversing mechanisms for band-cylinders for spinning-mules. In spinning the warp is twisted in one direction, and the purpose of the present invention is to provide means for changing the direction of speed of the bands within a minimum of time. [illegible]

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 18th or will be sent by mail on request.

(12159) A. S says Suppose that a person riding in a passenger coach traveling at a high rate of speed in a straight line and tightly closed, so that there would be no air currents in it, could jump straight up a few feet and remain suspended in the air for a short time without touching any part of the coach, would he or would he not drift toward the back end of the coach? Also would a feather or other light article dropped from the ceiling of the coach fall perpendicularly, supposing the speed of the car to be constant in both cases? A Our usual reply to questions such as you propound is "Try it and see" Would not you be surprised, should you drop a book or a coin in a railway car, to have it rush away to the rear door? The fact is that all things in a car have the motion of the car at all times, and by inertia they preserve that motion even when dropped out of the car window, excepting for the resistance of the air Inside the car the air is traveling along with the car, when doors and windows are closed, as you suppose to be the case in your question Therefore a coin dropped in a rapidly moving car will not drift toward the rear of the car, but will fall to the floor as if the car were still.

(12160) J C says 1 Would ask you to please let me know if there is a way to attach paper to an electrified body like metal or something else which could be electrified, on the same principle as a bit of paper is attached to a body which is electrified by rubbing, or on the principle of the canceling machine employed in the post office at Washington, which draws the envelopes by an electrified belt and transmits them to be canceled in another part of the machine A Small pieces of paper will be drawn to an insulated piece of metal just as they are drawn to a belt or any other insulator which has been electrified by friction The reason a belt is electrified is that it is an insulator and is rubbed by its slip on the pulleys as it runs over them. 2. Also kindly inform me the name of the book and author announced in the Scientific American about six or eight weeks ago for the main instruction of the winding of electric magnets and dynamos The price of it was $1 50. I looked for it and could not find it again A. Perhaps the book for which you ask was Poole's "Designs of Small Dynamos and Motors," price $2. We cannot tell from your description, but we often refer inquirers to this book, and you will find it very clear and practical

(12161) W J says Can you tell me if there are any railroads now using iron ties instead of wood, and what are their names and addresses? Do these ties give satisfaction? If so, why do the railroads persist in using wooden ties? A. We regret that we have no recent statistics of the use of metal ties in this country, but they are very little used as yet They were condemned after trials extending over ten years by three leading railroads twenty years ago, but it is our impression that the failure was largely due to the roadbeds. In Europe, where the greater density of population and consequently of available capital per mile of railroads permits a perfection of roadbed only recently approached in this country, metal ties are in use which have been in place under favorable conditions for twenty-five and thirty years, their long life more than compensating for their higher first cost as compared with wood ties. Considering the rapidly increasing cost of the latter and the great improvement in permanent way on the best American railways in recent years, it is our opinion that a repetition of the trials would result in a reversal of the former decision on the score of economy

(12162) S A. D says Severe storms of thunder and lightning with snow and hail are of daily occurrence at La Fundicion, Peru, during the winter and spring. What is remarkable to me is the form in which the hail or frozen snow falls. This is almost always conical, with a convex base, the conical part being crystalline, in narrow converging prisms, and fairly translucent, the base is usually whitish and opaque. These cones will measure pretty regularly ¼ inch to 1-3 inch from base to point and transversely A The authorities agree in the theory that hail is formed in a whirling mass of air, which rotates in such a way that the forming hailstones are carried up and brought down perhaps several times before they become heavy enough to break through and fall to the earth. These motions produce the layers which can be seen in all hailstones, since in the cold regions the ice is firmer than in the warmer regions, where the temperature may not be much if any below the freezing point. The section of such a ball is necessarily somewhat circular Often the ball itself is egg-shaped. A conical form is more [illegible]. We cannot think of any reason why a conical form should be usual in a particular locality.

NEW BOOKS, ETC.

Historical Guide to the City of New York. Compiled by Frank Bergen Kelley. New York Ferderick A. Stokes Company, 1909. 16mo., 420 pp. Price, $1 50

This book was compiled from original observations and excursions made by members and friends of the City History Club of New York. It is illustrated by 46 engravings, and there are 70 maps of the utmost value. The historical guide to New York is the result of prolonged investigations of the city of New York to discover old landmarks and direct attention to the yet visible traces of the old town which lie hidden away and are fast disappearing from the city of to-day It is a complete guidebook to New York city and its environs, in the form of various excursions, carefully laid out, with full directions and maps. It describes buildings and landmarks now standing, and refers fully to historical events which have taken place either in them or on their sites. There are excursions to all points of the city, and special ones to museums and art galleries, by water by automobile, for children, etc. Such a guide is necessary for a knowledge of New York, either by citizen or tourist, since there is no other Eastern city where the traces of historical events have been so thoroughly effaced (except in outlying districts) although the region is peculiarly rich in history It is an admirable treatise

Patents as a Factor in Manufacturing By Edwin J Prindle. New York The Engineering Magazine, 1908. 16mo , 134 pp Price, $2.

The purpose of this volume is indicated by the author at the outset and emphasized at the conclusion as not in any sense to make the inventor or the manufacturer his own patent lawyer It is rather to convey an idea of the nature of a patent, the protection it may afford, the advantages it may possess for meeting certain commercial conditions the safety which may be secured in relations between employers and employees, and the general rules by which the courts will proceed in upholding the patent and in thwarting attempted infringements, and to show the manufacturer, in a general way, what may be accomplished by patents, but not to lead him to attempt such accomplishment without legal advice. Based on these eminently practical premises, the author proceeds to unfold his subject in a very lucid manner It is one of the best scientific discussions of patents as we find them to-day that we have ever seen

American Business Law With Legal Forms. By John J Sullivan, A.M , LL.B. New York D Appleton & Co., 1909 12mo , 433 pp Price, $1 50 net.

This book, while designed for use as a text book in the class room, is so written as also to be of practical value to business men throughout the country The statements of law are clear and terse, and many illustrative cases serve at once to explain and to brighten the text. A set of questions will be found at the end of each chapter, and a number of forms are introduced in appropriate places. The volume is divided into five books Book One concerns Contracts. Book Two relates to (1) Agency, (2) Partnerships, and (3) Corporations. Book Three treats of Bailments, Personal Property, and Real Estate. A chapter is devoted to the subject of Common Carriers. Book Four discusses Suretyship and Guaranty, and Insurance Book Five deals with the Estates of Decedents and Trust Estates.

Direct Reading Slide Rule. With a Synopsis of Its Application to the Solution of Practical Problems. By George W Richardson. Chicago, Ill 4212 24th Place. 24mo., 25 pp Price, including celluloid and aluminium slide rule, $1 50.

This little work has been written as a guide rather than a treatise on the use of the slide rule. So much has been written on the subject that there is not much left to write about. Nevertheless, there is much to be learned about the practical application of this valuable instrument It has, therefore been the author's aim to deal with its practical application to the solving of the problems rather than to enter into any long-drawn-out, confusing statements as to the whys and wherefores in the case. What is wanted with the slide rule is results, and the author has certainly succeeded in producing one of the best direct-reading slide rules, and it is moreover sold at a price which places it in the reach of all draftsmen, and it is hoped that it may also reach business men as well. *If they only realised the range of problems* which this simple instrument can solve, the sales would be enormous. The rule before us will turn gallons into cubic inches, gallons into cubic feet, gallons into pounds of water, cubic foot into cubic inches , circumference vs. diameter circle , area vs. diameter circle side of a square vs. diagonal , kilowatts vs. horse-power B.T U vs. horse-power evaporation from and at vs. boiler horse-power , direct radiation vs. size grate , diameter safety valve vs square feet grate , area vs. side of an equal square , cubic feet air per minute vs. area duct in square feet diameter steam main vs. square feet radiation , piston speed, feet per minute horse-power of engine , horse-power of a waterfall ; belting vs. horse-power , how to square a number , how to find the square root of a number ; how to cube a number ; how to find the cube root of a number, etc.

Cyrus Hall McCormick His Life and Work. By Herbert N Casson Chicago A. C McClurg & Co, 1909 12mo., 264 pp Price, $1 50 net.

The author states that whoever wishes to understand the making of the United States must read the life of Cyrus Hall McCormick. This is true as regards agricultural machinery, for no other one man so truly represented the dawn of the industrial era—the grapple of the pioneer with the crudities of a new country the replacing of muscle with machinery and the establishment of better ways and better times in farm and city alike Beginning exactly one hundred years ago, the life of McCormick spanned the heroic period of our industrial advancement, when great things were done by great individuals The author further truly states that he fed his country as truly as Washington created it and Lincoln preserved it He abolished our agricultural peasantry so effectively that we have had to import our muscle from foreign countries ever since The book is a most fascinating one and as it passes on from generation to generation, it may finally be polished into an Epic of the Wheat the tale of man's long wrestle with famine and how he won at last by creating a worldwide system for the production and distribution of bread.

The Spatula Soda Water Guide. By E. F White. Boston Spatula Publishing Company Small 4to , 176 pp Price, $1

This is a complete compilation of valuable formulas and information for the manufacturer of carbonated waters and the dispensing of all kinds of carbonated drinks, the compounding of syrups, tinctures, extracts, fruit juices, etc , giving accurate instructions for the serving of each and every drink in the best and most attractive manner known Considering the enormous quantity of bad soda water with which the mass of people are served in large cities, it would seem that this book has a great field There is no good reason why quite elaborate drinks should not be dispensed at the ordinary fountains with the aid of such a complete compendium as the present volume Most of the formulas appeared originally in the Spatula , we notice that the author has recast many of them for this book, which hangs together very well and cannot be considered as a mere aggregation of formulas.

The Standard Guide for Locomotive Engineers and Firemen Also Railroad Machinists By Ed Turner Chicago Laird & Lee Vest pocket size Price, 75 cents.

INDEX OF INVENTIONS

For which Letters Patent of the United States were issued for the Week Ending December 21, 1909,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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Adjustable chair, A B. Dim	943 020
Advertising apparatus, W J Rider	943 803
Advertising device, W F Sweet	943 714
Advertising novelty, L. Feist	944,770
Advertising or display apparatus, A. Quentin	943 994
Agricultural purposes, spiked roller for, E. Nacke	943 949
Air brake adjusting device for loaded and empty cars, A. L. Goodknight	943,778
Air brake apparatus cut-out or release, S. P Cota	943 769
Air brakes, triple valve for W R. Mann	943,[illegible]
Air cooling apparatus, J B. Glockler	944 096
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Brick kiln brace A Ferusso 944,104
Brick press W C Short 943,797
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OXYGEN AND HUMAN ENERGY.

(*Concluded from page 6.*)

logical data. The air in our lungs is *complemental* (all that we can get into our lungs by forced inspiration); *tidal* (that which passes in and out in normal breathing), *reserve* (the air which can be expelled in forced expiration), and *residual* (which remains after forced expiration) Again, the pulmonary function is in obedience to the physical law of the diffusion of gases, by which a lighter gas (inspired air rich in oxygen) and a heavier gas (expired air laden with carbon dioxide) tend reciprocally to displace and replace each other From these physiological facts we comprehend that all the air inspired is not at the end of the given inspiration taken into the ultimate air vesicles, nor is all the vitiated air contained in these air vesicles expelled from them with a single expiration Thus, in any event, pure oxygen would never immediately reach its ultimate destination in the air vesicles, it would in fact get to them pretty much tempered, as in the normal. Nor is pure oxygen—so I would infer—ever supplied artificially for inhalation, if it were, it would probably not be respirable for any length of time, and would be positively injurious, if its use were persisted in

But now the use of pure, unmixed oxygen is being advocated for human beings who are in nowise ill, and there are circumstances in which such procedure might appear justifiable For example, Prof. W A. Anderson, a collaborator with Prof Chittenden of Yale, relates in the American Physical Education Review of May, 1909, in his article on "The Use of Oxygen in Mountain Climbing," that his party, leaving Mexico City, ascended Popo and Ixti, both of which mountains are above 17,000 feet high. Popo is the easier to climb, and was negotiated in the better weather, yet it presented the greater difficulties, and the party suffered much from mountain sickness and most distressing dyspnœa as the air became progressively rarefied On the other hand, when Ixti was negotiated, oxygen condensers were used, and by breathing this gas the top was triumphantly reached with but little of the distress that was experienced on Popo If these findings are corroborated, the one heretofore absolutely insurmountable difficulty in scaling the world's highest peaks should be eliminated, even Everest (24,000 feet) should be conquered, and almost any fair climber should be able to find that flag alleged to have been planted atop Mount McKinley

But other procedures are being advocated which do not appear to me so justifiable For example, Dr. Leonard Hill has been seeking to prove that oxygen is more sustaining than air, his experiments demonstrate that after the use of this gas one may hold the breath more than nine minutes I do not know what proportion of oxygen was used in the experiments, whether the gas was taken pure, or whether some compound of it was employed. The result stated is of course amazing, but it is not exceptional Trained and expert swimmers remain under water a number of minutes, when, of course, they have to hold their breath If memory serves me aright, I once saw a man in an exhibition remain in a tank under water twenty minutes. Dr Hill concludes that by taking oxygen before a quarter-mile race, an athlete should be able to hold his breath during the whole race, and devote the energy thus saved to faster running Somewhat more than a year ago, Dr Hill reported experiments he had made which he believed would lead to the breaking of athletic records, and his work was no doubt the incentive to like experiments since made in other scientific centers Dr Hill's experiments led him to think that the panting and distress of athletes might be largely mitigated by breathing oxygen deeply before and after a race; the former to prevent distress and to increase running powers, the latter to relieve whatever distress occurs. At the London Hospital athletics oxygen was given to some of the runners immediately after the races, and greatly relieved their distress. A well-known athlete, Mr. Holding, ran an unpaced quarter of a mile in fifty seconds after breathing oxygen for three minutes; in the trial for the Olympian games he had been unable to do this in less than fifty-two seconds. It seems he was not more distressed than if he had run one hundred yards; there was, it was reported, a notable absence of that stiffness of the muscles and grogginess in the legs which follow great exertion in running. Another athlete, Mr Just, after breathing oxygen for three minutes, ran half a mile in one minute and fifty-five seconds, slightly beating his record.

I confess I am not much impressed by these achievements. I think, on the contrary, the preliminaries to them were reprehensible. Oxygen is a stimulant,* and it is for its stimulant properties that Dr. Hill advocates its use in athletics. This is especially bad for young men, who are generally our athletes. Youth should need no stimulants. We observe, moreover, the oxygen is given before a race, this is decidedly both unsafe and unphysiological. Human energy is thus increased, but the increase is abnormal, as is also the expenditure of energy. Nor are the sequelæ without disaster Do not our athletic young men, as it is, grow into maturity with bad enough hearts? Every doctor must give melancholy testimony that such is the case But here we are advised to stimulate unnaturally a heart already functioning to its limit. And it is unphysiological to give any stimulant before a feat of strength or a trial of endurance, capabilities are thus perversely and unnaturally overwrought. All stimulants—oxygen, whisky, coca, and the like—should be given not before, but after, a race, a journey, or a mountain climb, in order to restore the economy to par after the undue exertion. Here is a matter which seems to me not altogether trivial.

Besides, this "doping" of contestants before a race is unsportsmanlike. Tests of physical brawn and endurance are legitimate only when they are made under normal conditions—those in which human life must ordinarily be lived. The true sportsman will countenance athletics only when the contestant depends for success upon no other factors than his better physique and superior skill. Oxygen stimulation would possibly make an untrained, undeveloped, short-winded, soft-muscled specimen successful for the brief span of a given contest; but for all that he would be the poorer and not the better man. It may be recalled that some years ago a bicyclist "made" a mile in less than a minute, behind a railway train going at that rate; a smooth board course had been laid between the rails—and this was permissible enough But a shed had been built out from the rear of the last car, within which the rider kept. He was thus protected from the winds, especially headwinds, and was moreover assisted by the suction exerted by the fast-moving train. Genuine sportsmen rightly held his record to be valueless; for it was achieved under unnatural conditions, not under such as must be chanced and grappled with in nature.

* By stimulant is here meant an agent tending to excite [illegible] action. The physiologist [illegible] agent (such as oxygen) a stimulant which [illegible] quickly diffused and [illegible] vitality and energy; there are also medical stimulants [illegible] alcohol [illegible]

DAVID STARR JORDAN.

(*Continued from page 12.*)

of fishes, in the knowledge of which he now stands among the very foremost in this country. In 1875 he was elected to the professorship of biology in Butler University, which place he then held un-

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til 1879, when he was chosen to fill a similar chair in the University of Indiana, in the possession of which he continued until 1885, when he became president of that university

In 1885 Leland Stanford, who had served the State of California as its Governor and as its representative in the United States Senate, founded in memory of his son the Leland Stanford Junior University, having as its object to "qualify students for personal success and direct usefulness in life." This university with the richest foundation of any similar institution in the United States at that time, was formally opened on October 1st, 1891, with Dr Jordan as its president. Since that time he has continued to fill that important office, fulfilling with rare skill and unusual ability the will of its founder, who publicly said that "a generous education is the birth right of every man and woman in America."

Dr Jordan's great knowledge of fishes was early taken advantage of by the U S Bureau of Fisheries, and from 1877 until he went to Stanford University he served as assistant to the U S Fish Commission, as it was then called During 1896-98 he was a U S commissioner in charge of fur sealing investigations, and in 1904 was given charge of certain investigations in regard to the salmon for the government. In connection with his official researches he has made many trips on the Pacific, frequently visiting Alaska, Hawaii, and far-away Japan, making large collections, selections from which, especially types of new forms, have been deposited in the U S National Museum Of the publications of this institution, he prepared as "Contributions to North American Ichthyology," three bulletins entitled respectively I "Review of Rafinesque's Memoirs on North American Fishes" (1877), II A "Notes on Cottidæ, Etheostomidæ, Percidæ, Centrarchidæ, Aphododeridæ, Dorysomatidæ, and Cyprinidæ, with revisions of the genera and descriptions of new or little known species" B "Synopsis of the Siluridæ of the fresh waters of North America" (1877), and III A "On the distribution of the fishes of the Alleghany region of South Carolina, Georgia, and Tennessee, with descriptions of new or little known species" B "A Synopsis of the family Catostomidæ" (1878)

He has further enriched the many volumes of the Proceedings of the U S National Museum with accounts of his discoveries, which have gained for him the reputation of being the foremost authority on the sea fauna of the Pacific By far however, his greatest contribution to the Smithsonian publications is the well known Bulletin No 47, which he prepared in co-operation with Barton W Everman It bears the title of "The Fishes of North and Middle America," and is essentially a descriptive catalogue of the species of fish like vertebrates found in the waters of North America, north of the Isthmus of Panama In it are described 225 families, 1,438 genera and subgenera, and 3,393 species and subspecies It forms four octavo volumes covering 3,313 pages with 392 plates, in which nearly 1,000 fishes are illustrated

Dr Jordan is also the author of "A Manual of Vertebrate Animals of Northern United States", "Animal Life", "Animal Forms", "Food and Game Fishes of North America", and "A Guide to the Study of Fishes." Several of these works were written in association with his scientific colleagues of the Bureau of Fishes and Stanford University.

His more popular contributions to literature include the following works in book form "Science Sketches", "Foot notes to Evolution", "Care and Culture of Men", "The Innumerable Company", "Imperial Democracy", "The Philosophy of Despair", "Voice of the Scholar", "The Call of the Twentieth Century", "The Human Harvest", "Evolution and Animal Life", and a single volume of

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Shaft, flexible, W. G. Nambridge 944,[illegible]
Sheet metal panel, A. J. Thornley 944,[illegible]
Shell crimper, J. E. Thompson 943,[illegible]
Shingle, interlocking metallic, G. H. Pedlar 943,[illegible]
Shock absorber hanger, E. Piertje 943,[illegible]
Shoe block, W. W. Kimble 943,[illegible]
Shoe filler, H. R. Taylor 944,1[illegible]
Shoveling board, Stewart & Neiswanger 944,1[illegible]
Sifters, control device for, A. C. Brenting-ham, reissue 13,[illegible]
Sign holding apparatus, C. P. Hall 944,1[illegible]
Signal system, electric, A. I. Rohm 944,0[illegible]
Signal system, theater chair, I. T. Keane 943,[illegible]
Signaling and switching apparatus, electrical, B. H. Manson 943,[illegible]
Singeing machine, Davis & Berry 943,[illegible]
Skiving machine, Palmenter & Allen 943,[illegible]
[illegible] W. R. Haughton 943,[illegible]
Slicing or chopping machine, fruit and vegetable, W. H. [illegible] 943,[illegible]
Smoke consumer, A. [illegible] 944,[illegible]

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[illegible]

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Stove ventilator and hood, cook, F Bernstein ... 944,170
Strainer, vegetable, J. McDonald ... 944,144
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Straws, dust proof receptacle for tubular, J Hurley ... 943,879
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Studding, metallic Mooney & Jantzsch ... 943,896
Suit case and the like, H. Lodescher ... 943 793
Suspenders, B. S. Hersvitch ... 943,976
Swingletree G F Thompson ... 944,114
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Switch indicator, O. A. Clark ... 943 914
Switch operating device, W. N Glosser ... 943,936
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Switchboard and cut out, T. E. Murray ... 943 699
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Table, C. Van Horne ... 943,719
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Thread, means for detecting enlargements in, J Eastwood ... 944 062
Tile and tile faced surface, W. P. Meeker ... 943 050
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Transportation system, W C Carr ... 943,810
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Truck, car, Whitridge & Goodspeed ... 943 853
Truck, car, A J McCauley ... 944,203
Truck for cars, swing motion, C D Young ... 944 165
Truck, railway car W F Richards ... 943,707
Truck structure for garbage or ash cans, M T Lyon ... 944,197
Trucks construction of car, Wright & Stebbins ... 944 110
Trunks, device for packing hats in, B. Dickerson ... 943 810
Truss A. A. King ... 943 693
Truss pad, I M Pease ... 943 843
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Tubes, screw cap for collapsible, F McIntyre ... 944,203
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Typewriting machine, Barron & Merritt ... 943,044
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Valve W T Fowden ... 944,038
Valve, W Shurtleff ... 944 105
Valve, air, H. A Fitzpatrick ... 944,021
Valve device J Miller ... 943,837, 943 838
Valve disk cutting machine Smith & Williams ... 944 002
Valve, flushing, M B Mahurin ... 944 099
Valve for evaporating pans G G Chase ... 944 173
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Valve or cock, blow off, W T Fowden ... 944,035
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Vehicle ventilating device, Pope & Lester ... 944 189
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Watch balance staff supporter, L Primont ... 943,890
Water motor W. G Stowell ... 944 231
Waterproofing composition L A Coleman ... 944,338
Weather strip, J. H. Lederman ... 944,042
Weather strip, movable, J & J Hemmerling ... 944,093
Weed digger, R. R. Dumonde ... 943 817
Weed exterminator, E. A Francis ... 944,093
Welding burner, J Knappich ... 943,893
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Well cleaning device, F A. Monroe ... 943 965
Well sinking apparatus, M. T Chapman ... 943 918
Wheel fender Mayson & Edgar ... 944 100
Wheels, detachable rim for vehicle, P. G. Challiss ... 943,871
Whip lock, W. H. Beach ... 943 720

[illegible]

A printed copy of the specification and drawing of any patent in the foregoing list, [illegible] New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. [illegible]

(Concluded from page 17.)

verse entitled "To Barbara." Many of these books are collections of his lectures and addresses before popular audiences, for Dr Jordan has always been in demand as a speaker from the lecture platform

Many honors have come to him The degree of M D was conferred on him by the Indiana Medical College in 1875, that of Ph.D was given him by Butler University in 1878, while that of LL D was conferred on him by his alma mater in 1886, and by the Johns Hopkins University in 1902 He is a member of many scientific societies, including the American Philosophical Society, and during 1896-8 he was president of the California Academy of Sciences Besides the foregoing he is a vice president of the Carnegie Foundation for the Advancement of Teaching

The American Association for the Advancement of Science enrolled his name among its members at its second Montreal meeting in 1882, and a year later he was advanced to the grade of Fellow The section on Biology made him its vice-president for the year 1895, but absence from the country prevented him from accepting the office on that occasion Accordingly in 1900 he was again chosen, and presided over the section at the Denver meeting, delivering a retiring address on "The Fish Fauna of Japan with Observations on the Geographical Distribution of Fishes" At the meeting held in Baltimore a year ago this time Dr Jordan was the unanimous choice of his scientific associates for the highest office in the gift of the Association, and will take the chair at the Boston meeting

A NEW GAME

(Concluded from page 11.)

It consists in general of a peg provided with a set of recesses which are numbered 5 10 15, etc and a projecting device adapted to throw a ring on this peg, so that it will hang from any one of these recesses The projecting device casts the ring in such a way that it turns a complete somersault in transit, which adds to the difficulty of making the ring fall in the recess bearing the highest number The projecting device is shown in detail in cross-sectional view It consists of a lever A provided at its lower end with a flat plate B adapted to receive the projectile The lever A is mounted between a pair of uprights C and a spring D presses the lever upward against a stop piece The ring E is placed on the plate B and then the lever is raised as indicated by the dotted lines, and on being suddenly released throws the ring to the peg F The recesses above referred to are indicated at G It will be evident that considerable skill is required to gage the exact height to which the lever A must be lifted, so that when released it will throw the ring to the desired recess To assist in operating the projector the top crosspiece of the frame C projects at each side, and provides a rest for the fingers while the thumb is engaging the end of the lever A The inventor of this game is Mr Pierre V Ericson, Cherokee Avenue, Hollis, Long Island N Y

In a recent number of the *Zeitschrift Phys. Chem*, T Svedberg describes some experiments on the limit of visibility of color produced by various substances in dilute solutions passing from copper sulphate to fuchsine and colloidal gold It is shown that in the case of colloidal particles the absorptive power is at first almost independent of the size, but proportional to the number, of the particles On reducing the size of the particles, however, their absorptive power becomes less and finally the ordinary condition of a transparent (true) solution is attained Svedberg argues that his experiments demonstrate the continuity of the colloidal and crystalloid states, and therefore the corporeal existence of molecules

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THE SPEED OF AN AEROPLANE PROPELLER —[See page 27]

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NEW YORK, SATURDAY, JANUARY 8th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A NEW ERA OF THE STEAM ENGINE.

If in the days of the perfected quadruple-expansion steam engine, anyone had ventured to criticise the type as being very inefficient as a means of extracting the heat energy of the steam that passed through it, he would have been considered as hypercritical, to say the least. And if he had ventured to predict that within a few years, by interposing a certain device between the low-pressure cylinder and the condenser, it would become possible to show an increased economy of from 25 to 35 per cent, and, in some cases, to increase the total horse-power output of an engine by from 70 to 100 per cent, he would have been regarded as a visionary. Yet it is a fact that this doubling of the capacity of an engine has actually been accomplished, as stated in our editorial of December 18th, 1909, describing the remarkable work being done at the Fifty-ninth Street power station of the New York subway system.

It is no exaggeration to state that the low-pressure turbine has introduced an era of improvement in steam-engine practice which is destined to mark an advance in the art, greater than any recorded during the past century of the history of this great prime mover, and we say this with full appreciation of the progress that was made with the introduction of compounding and the later multiple-expansion engines.

A century ago, as we recently showed in our discussion of the low-pressure condensing engines of the time of Robert Fulton, boilers were so weak and steam pressures so low that the condenser was an absolutely necessary accessory. When iron and steel plates became available for boiler manufacture, there was a corresponding rise in steam pressure, which led to a gradual abandonment of the condenser and a tendency to obtain the desired horse-power by working on the higher ranges of pressure. The high-pressure engine exhausting directly to the atmosphere was, of course, an extremely wasteful device, and the invention of the compound engine was logical and inevitable. Then followed the triple and quadruple engines, the limit of expansion being reached when the low-pressure cylinder became too large for practical purposes. If a cylinder were built that would carry the expansion of the steam down to the full theoretical limit of reciprocating-engine efficiency, its dimensions would be exaggerated out of all proportion to the rest of the engine; the weight would be enormous, and the losses through friction, and because of the great radiating surface, would be prohibitive.

The steam turbine, on the other hand, is particularly adapted for accommodating the great expansion of the steam in the lower ranges of pressure, just as the reciprocating engine is better suited for developing the expansion in the higher ranges. The turbine losses in the higher ranges are largely due to the friction of the rapidly revolving blades in the steam at its relatively high density when under high pressure, whereas skin friction is not a serious factor during the expansion of steam in a high-pressure cylinder. At the lower pressures the steam has a small density, and the skin friction losses are inconsiderable. Again, the great drop in temperature in a low-pressure cylinder induces rapid condensation, and greatly reduces the efficiency.

Hence, it will be seen that the reciprocating engine working on the higher ranges of pressure and the turbine working on the lower ranges are the complements, the one of the other, and when acting in combination form an ideally economical arrangement.

The range of application of the new system is wide, and already the turbine is winning back for useful work an enormous amount of heat which was formerly lost in the reversing rolling engine at the steel works, in the winding engines of collieries, and in the power houses of various industrial establishments, where it has become possible to run an addition to the [illegible] on the power recovered between cylinder and condenser. The largest steamships in the world, now under construction, will embody the same combination in their engine rooms. In these days of anxiety over the rapid depletion of our natural resources, the auxiliary steam turbine must be welcomed as one of the greatest conservers of our supplies of coal and liquid fuel.

RAPID TRANSIT BY BELT CONVEYER.

By the action of the Board of Estimate of this city, which, on December 3rd last, passed a resolution authorizing the Public Service Commission to lay out a moving platform subway in Thirty-fourth Street between Second and Ninth Avenues, there will be given an opportunity to test a system of transportation which we have always considered to be ideally adapted for relieving the crowded traffic conditions in congested centers of large cities.

By far the most efficient means of moving material in bulk is the belt conveyer. For transporting material that is in a more or less finely divided condition, or made up of a large number of small separate units, such material, for instance, as grain, coal, or iron ore, the belt conveyer is recognized in the industrial world as having no equal—provided, of course, that the distance to which the material is to be carried and the speed are not excessive.

The moving platform is practically a continuous belt conveyer for the conveyance of a large number of passengers at moderate speed. It consists of short lengths of platform, coupled together, forming an endless chain which is kept in continuous motion. In the Thirty-fourth Street subway there will be four parallel rows of platform, the first, adjoining the station platform, moving at three miles an hour, the next at six miles, the third at nine miles, while the fourth, which will be entirely covered from end to end with seats, will move continuously at twelve miles an hour. Entrances to the moving-platform subway will be placed at every intersecting avenue or street, as the case may be. The capacity will be 73,500 seated passengers per hour in one direction during the rush hour, as against 13,000 seated passengers on the eight-car express train service and 7,500 on the five-car local train service of the subway, and as against 36,000 standing and seated passengers per hour on the express service and 22,500 on the local service.

In a recent communication to the Public Service Commission by its chief engineer, Henry B. Seaman, the advantages of the new system are stated to be: First, a vastly increased capacity and seats for all passengers, second, absence of the delay incurred by waiting for trains at stations since the train is always there and constantly moving; third, the fact that passengers may board or leave the train at any point at will, and that instead of placing stations one-third of a mile apart, as on the present subway, they may be placed at every cross street, or indeed at any intermediate point. Furthermore, the subway construction may take the form of a continuous arcade, thus providing an additional business front for display and shopping purposes.

Although the moving platform speed of twelve miles per hour may seem somewhat slow as compared with the running speed of a subway train, the difference is not nearly so great as might be supposed, and, indeed, over the shorter distances, is entirely in favor of the new system. The Commission's engineer finds that for all distances of less than four miles the moving platform is a quicker and more convenient mode of conveyance than the local train service, or even quicker than the local and express service combined, a passenger reaching Times Square Station, Forty-second Street, from any local station south of Fourteenth Street quicker by the moving platform than by the local and express trains of the present subway. The local trains ordinarily average, including stops, about fifteen miles per hour, and twelve miles an hour during the rush of traffic. If this rush hour service is compared with a platform speed of twelve miles the platform will have the advantage for all distances, because there is no train interval to wait and no distance between stations to walk.

To our mind the principal difficulty with such a system will be in accustoming passengers to step from one surface to another that is moving three miles an hour faster. Were it not for the great advantage of ample seating accommodation, [illegible] and total absence of waiting, to say nothing of the avoidance of the present [illegible] crowding, one might anticipate some reluctance on the part of the public to make use of so novel a means of [illegible]. Experience with escalators, however, would indicate that the public will quickly become familiar with the motion of the platforms. If the new Thirty-fourth Street venture fulfills its promise, it will mark a new era in the history of [illegible].

[illegible]

Several [illegible] English railroads to many similar [illegible] electric traction to those which have attracted so much attention recently in this country. Chief among these are the Mersey Railway, [illegible] lines of the North-Eastern and the Midland, and a section of the London, Brighton and South Coast. Some of these roads have now been sufficiently long under electric operation to afford data for reliable comparison of the relative economies and advantages of operation by steam and by electricity, and the facts which were given at a recent meeting of the Institution of Civil Engineers prove that the adoption of electric traction has been abundantly justified. A comparison of three years' operation of the Mersey Railway under both methods shows that the locomotive and car expenses have been considerably reduced. Furthermore, under steam traction one pound of coal costing sixteen shillings per ton moved one ton 2.21 miles at an average speed of 17¾ miles per hour; whereas under electric traction one pound of coal costing eight shillings and nine pence per ton moved one ton 2.29 miles at an average speed of 22¼ miles per hour. The cost of maintaining the track and roadbed has been reduced from 0.0208 of a penny to 0.0089 of a penny per mile. Under steam traction the rails required renewal after carrying 22 million tons, under electric traction their capacity is 47¼ million tons. Furthermore, electrification has raised the average speed on the Mersey Railway, including stops, from 15.6 to 19.9 miles per hour, the number of ton-miles per annum has gone up from 43 to 67 million, and the total expenses per ton-mile, even with the interest on capital cost of the electric installation reckoned in, have been reduced from 0.344 to 0.293 of a penny.

On those branches of the North-Eastern Railway that have been electrified, the train mileage has been doubled, the platform capacity of the main station at Newcastle has been increased, and the number of signal movements has been reduced by one-half. These advantages, coupled with the higher rate of acceleration of the electric trains, have enabled these roads to carry a traffic that would have completely swamped the old steam service.

It is of interest to note that in connection with the electrification of a branch of the Midland Railway, tests which are being made of the relative advantages of direct-current and single-phase operation seem to show that not only is the single phase taking care of the same service as the direct current, but that the weight of the trains is only slightly greater, and the consumption of energy somewhat less. It is to be hoped that our New York Central and New Haven systems, which are operated respectively by the direct and the alternating current, will make public, for purposes of comparison upon a common basis, the results of the past two years of electric operation. If these figures were given, together with the cost of steam operation of these same sections of road, the electrical world would be furnished with a mass of data of exceptional value and interest.

PRIZES AT THE LOS ANGELES AVIATION MEETING.

The prizes that are to be competed for by heavier-than-air machines at Los Angeles (January 10th to 20th) are the following:

$10,000 for the machine which, carrying two or more persons, breaks all world's records for duration, altitude, distance, and speed.

$7,500 for the machine making the best general average in all events. $5,000 for the machine which breaks all previous records and makes fastest circuit of the course. $5,000 for breaking height record. $5,000 for breaking endurance record.

$500 each for the circuit of least diameter; leaving the ground in the shortest time; shortest distance required in starting; greatest ability during flight (general average); longest glide with motor shut off; best general average in landing at given point. A prize of $1,000 for a machine designed and built by a resident of California, Arizona, or Nevada which flies 5 miles and one of $500 if a flight of over 2 miles is made; $500 for a machine designed and built in California which flies at least 5 miles. A prize of $1,000 is also offered for a machine that can soar (not glide) without power save that of [illegible].

A prize of $10,000 [illegible] which flies from [illegible] another of [illegible] carrying [illegible] San [illegible] miles respectively. A [illegible] and [illegible] [illegible]

ENGINEERING.

There has recently been launched at Bath, Me, the largest wooden vessel ever built in the United States The "Wyoming," as she has been named, is a six masted schooner of 3,730 gross tons, with a total length over all of 350 feet. Next to her in size among wooden vessels is the "William L. Douglas" with a gross tonnage of 3,708

The launch of the battleship 'Utah' at the yards of the New York Ship Building Company Camden, N J signalizes, for the time being, the possession by the United States navy of the largest battleship afloat. Both this ship and the Florida now being built at the Brooklyn navy yard are of 21 825 tons displacement, and each will carry ten 12 inch guns

Toward the close of last year the four mile tunnel through the Andes on the line of the new transandine railway between Chili and Argentine was broken through The tunnel lies on the Chilian side of the boundary line between the two countries and forms the summit of a new single track road It is expected that the tunnel will be completed and the whole line opened in the spring of the present year

In his annual report to the Secretary of War Gen Murray Chief of the Coast Artillery announced that the difficult problem of mining the waters of the race at the eastern entrance to Long Island Sound has at last been solved By using anchors of 1 500 pounds weight mines were successfully anchored at the great depth of 200 feet A complete submarine equipment for the race' will soon have been put in place

The British Congo section of the Cape-to-Cairo Railway 134 miles in length was formally opened on December 12th It extends from the Chartered Company's terminus at Broken Hill to the southern frontier of the Congo Independent State This completes a continuous British line of 2 147 miles north from Cape Town Work is in progress on an additional 160 miles which will probably be completed in the autumn of 1910

The "Vanguard" of the British navy which has now undergone her trials with a maximum high power speed of a fraction under 22 knots is the fourth dreadnought to be completed for the British navy Her displacement is 19 250 tons She carries ten 12 inch guns disposed similarly to those of the original Dreadnought that is with six on the center line and two on either broadside On the full power trial the coal consumption per shaft horse power was 1 68 pounds and the main steam consumption was less than 14 pounds per shaft horse power per hour

The United States Engineer Corps are engaged in surveying the route of the proposed Atlantic Coast Canal from Boston Mass to Key West Fla The scheme calls for a canal from Boston to the coast through Long Island Sound to and across New York Bay thence across New Jersey to the Delaware River thence to Norfolk on Chesapeake Bay and thence to the sounds of North Carolina and Beaufort Inlet The law providing for this survey calls for surveys for a 25-foot ship canal from Boston to Beaufort and a 12-foot canal from Beaufort to Key West The estimated cost is $100 000 000

To facilitate traffic across the huge Culebra cut and to carry certain air and water mains a highway suspension bridge with a span of 600 feet has been built across the cut at Empire Most of the material for the bridge was found on hand at Panama The stiffening truss was made up of 4 x 6 and 6 x 6 timber and the towers were built up of 6 x 12 and 5 x 10 creosoted pine timber bolted up in 16-foot lengths The main cables 870 feet in length are 2¾ inches in diameter and have each a tensile strength of 170 000 pounds to the square inch

The managements of several railroads have followed the lead of James J Hill in impressing upon the farmers the need for conservation of the fertility of the soil and they are using for this purpose the demonstration train One of the latest of these equipped by the Pennsylvania State College is being operated on a division of the Pennsylvania lines and other instruction cars are following a route through Iowa and Nebraska. The return to the railroads for the outlay for this enterprise will consist in the increased amount of freight brought to their lines as the result of more intelligent farming.

The introduction of the articulated compound type has made it possible for the railroads to greatly increase the effectiveness of existing locomotives which have become unequal to the work demanded The Baldwin Locomotive Works have recently enlarged a consolidation engine for the Great Northern Railway by extending the boiler shell to include a superheater and feed water heater, and placing beneath the extension a separate low-pressure six-coupled engine It is estimated that the coal consumption per ton mile will be reduced by nearly 50 per cent, 10 per cent being due to superheating, 15 per cent to feed-water heating, and 25 per cent to compounding.

ELECTRICITY.

The Nobel prize for physics has been divided this year, one-half being given to Guglielmo Marconi for his development of wireless telegraphy and the other half to Prof F K Braun of Strasburg University Germany, for his work in radio-activity

Experiments are under way to establish wireless telegraph communication between Japan and San Francisco by way of Hawaii Also to telegraph direct from Japan to San Francisco So far these efforts have been unsuccessful although telegrams have been received in Japan from Hawaii However the transmission was too uncertain to be of any commercial value

The scout cruisers 'Birmingham' and Salem were sent recently on a cruise to test the efficiency of their wireless telegraph system and that of the station at Brant Rock Mass The cruisers were to attempt to maintain communication with each other over a distance of a thousand miles and with the land station over a distance of three thousand miles Owing to severe storms the test was not very successful Doubtless further tests soon will be undertaken under more favorable conditions

A new steam-electric locomotive is being built in England It comprises a steam turbine which operates a dynamo supplying current for four series wound motors The engine is being designed to haul express trains and will be tested in actual service so as to show its efficiency as compared with the ordinary steam locomotive It is pointed out that turbo generators have proved so efficient in stationary plants that a similar system would very probably prove to be of value on railways to replace steam locomotives

A writer in Engineering (London) calls attention to the water power of Iceland which is going to waste A company is now being formed to exploit these power resources The Skjälfandi River Falls comprise the Goda Falls with 39 200 horse power the Aldeyjar Falls with 35 800 horse-power the Barma Falls with 17 000 horse-power The Laxau River Falls would produce 30 000 horse power the Sog Falls 50 000 to 70 000 horse-power and the Guldfoss Falls 100 000 horse power With all this hydraulic power available Iceland would seem to be an ideal spot for the generation of electricity particularly for use in electro chemical industries

A press report from England speaks of a remarkable development in wireless telephony which will make it possible within a few weeks to carry on conversation between Paris and New York As the record distance over which wireless telephonic conversation has been held even under the most favorable conditions is but a hundred miles or so it is impossible to believe the press dispatch It is very difficult to telegraph over so great a distance and as the developments in wireless telephony are in their infancy and far short of those in wireless telegraphy it is probable that we will have to wait many years before conversation can actually be maintained between the cities named

A new type of car has been built for a line in Brunswick Ga in which the conductor is eliminated The cars are of the pay as you-enter type but may be entered only from the front platform where the fare is deposited in the cash box under the motorman's eye The cash box is provided with a glass receiver in which the fares may be examined before being dropped from the tilting bottom into a locked cash drawer The cash box must be moved to the other platform when the car is on its return trip and this has made it necessary to provide certain precautions to prevent coins from dropping out in case the box is turned upside down and to lock the cash drawer when the box is removed from the support The box is also provided with a fare-counting machine

An interesting comparison of the New York and Paris subway systems was published in a recent number of the Electric Railway Journal The following conclusions were reached In the Paris system the average fare is but 2 7 cents with a minimum fare of 1 19 cents at certain hours of the day The Paris system offers universal transfers over a complicated network of lines, and when this network is completed a passenger may travel from any quarter of the city proper to any other quarter for a single fare Our own system on the other hand charges a much higher fare, though the possible ride is longer Allowing for difference in purchasing power of money the charge per mile for the average ride is from one and one-half to two times as great in Paris as in New York The lines extend into undeveloped areas fourteen miles from the center of traffic as against three or four miles in Paris and a greater speed is attainable The average speed in Paris is but twelve miles per hour while in New York on the express tracks between the Brooklyn Bridge and 96th Street the rate is twenty four miles an hour including stops while the average speed for both express and local trains for the entire system is eighteen miles per hour

SCIENCE

Former President Roosevelt's African hunting trip will result in enlarging the Smithsonian collection by 6 663 skins The collection consists of hides of 243 large mammals 1 500 small mammals and 1 356 stuffed birds Human skulls picked up along the line of the ancient slave trail are also included

Prof. Hergesell, Count von Zeppelin's mathematical and meteorological adviser is now in New York He states that two airships will be used by Count von Zeppelin with a view to exploring the entire region within the Arctic Circle One will probably be left at a relief station in Spitzbergen while the other is on its journeys the two keeping in touch by means of wireless telegraphy The German government will undoubtedly aid the undertaking financially

Charcoal, graphite and diamonds are only different forms of one chemical element carbon Hitherto carbon has been regarded as infusible but it has apparently been fused in experiments which were described by the Italian physicist La Rosa at the last International congress of applied chemistry By subjecting very pure sugar charcoal to the intense heat of the singing electric arc La Rosa obtained a compact mass of graphite When this mass was cooled quickly minute transparent crystals appeared which were proved to be diamonds by their form chemical composition and physical properties

Dr W von Oechelhaeuser has invented a method of converting ordinary coal gas into a very light gas which is eminently suitable for filling balloons The process consists in decomposing and removing all of the heavy hydrocarbons and nearly all of the methane and converting the carbon dioxide into the lighter carbon monoxide The resultant product is an almost odorless gas which contains more than 80 per cent of hydrogen and has a density of 0 2? The density of ordinary coal gas is 0 41 and that of pure hydrogen is 0 067 The lifting power of the new gas is about one ounce avoirdupois per cubic foot the buoyancy of coal gas is 0 7 ounce and that of commercial hydrogen is 1 1 ounce per cubic foot The balloon of the Aeronautical Society of Anhalt is to be filled with the new gas

A kitten about six months old was taken to a house a few miles distant from its birthplace confined in a room and tenderly cared for during a week and then set at liberty It was supposed to have become habituated to its new surroundings but it returned to its old home on the day of its release The sense of locality and direction was exhibited still more strikingly by an old tom cat which was stolen and carried a distance of 20 miles confined in a bag The cat was imprisoned but made its escape and in a few days reappeared in a pitiable state at the home of its former master which was separated from that of the thief by a high wooded cliff

A writer in Kosmos states that he possesses a tame magpie to which he sportively offered an extinguished cigar stump The bird began to tear the stump apart but apparently changing its mind proceeded to nib the stump held in its beak over every part of its body including the inside of the wings in a very careful and methodical manner The experiment was subsequently repeated many times always with the same result This magpie is so fond of tobacco that it has repeatedly snatched a lighted cigar from his hand against his will It also picks up fallen cigar ashes and strews them over its feathers He thinks these actions have a purpose the destruction of parasites and are determined by atavism or inherited instinct In the wild state some unidentified plant must have been used instead of tobacco as an insecticide The magpie's action furthermore seems to be an unquestionable instance of the use of tools by a lower animal

A great number of elements was studied by Madame Curie but with the exceptions of radium uranium and thorium she found no elementary substance possessed of a radio-activity greater than one one hundredth of that of metallic uranium Campbell made a similar series of examinations by a more sensitive method and came to the conclusion that potassium rubidium and lead are radio-active but Elster and Geitel have traced the radio-activity observed in lead to a small admixture of radium F i e polonium Levin and Ruer have recently tested the radio activity of a great many substances Their experiments confirm Campbell's results in regard to the radio activity of potassium and rubidium This radio-activity however is very small being in the case of potassium only 1/1 000 of the activity of the β radiation of uranium oxide In this case the radio activity cannot be attributed to impurity as the potassium compounds examined were derived from many different sources They included commercial compounds potash salts obtained from molasses distillery wastes and wool washings Stassfurt potash rock etc One specimen was obtained from the ashes of Russian sunflowers a second came from the Tyrol and the third from Chile

A UNIVERSAL VISE.

BY JACQUES BOYER.

Vises usually occupy fixed positions and serve merely as clamps by which the wood or other material is prevented from moving while the workman is compelled to adapt the position of his tools and his body to circumstances as best he may The ordinary vise no matter what the purpose for which it is designed consists of two jaws one fixed the other movable The latter is moved toward and away from the former by a strong square threaded screw which turns in a nut in the fixed jaw and in a collar in the movable jaw and the movement is opposed by a flat spring which takes up the lost motion

The universal vise invented by P Gloag en is mounted on a ball and socket joint which allows it and the object held by it to be turned in any direction so that the work can be done more conveniently and in a favorable light When the vise has been set in the desired position the ball and socket joint is locked and held motionless by a double jointed jaw operated by a strap terminating in a loop in which the workman's foot is placed

As the accompanying photograph indicates the universal vise is designed primarily for the use of shoemakers It can be employed with advantage in shaping sewing nailing and almost every other operation involved in the making and repairing of shoes The shoe and the standard which carries it can be turned into any position and instantly immobilized without touching the screw of the vise so that shaping can be done much better than is possible with a rotating vertical standard as the sole and the heel can be placed in the positions most favorable for working

The apparatus is very simple and comprises only five large parts and two pins.

THE UNIVERSAL VISE

The Pacific coast lumber manufacturers have taken the initiative in an important step for the promotion of proper and conservative use of their timber supply Practically all of the large manufacturers of lumber in the States of Oregon and Washington have entered into an agreement to manufacture odd as well as even lengths in flooring finish and similar planing-mill products. Heretofore it has been customary to manufacture these products in even lengths only Now it is proposed to trim the manufactured lumber to lengths of odd numbers as well as even numbers of feet Under the old system a considerable portion of the lumber which came to the shaping machine was wasted and this action has been taken in order to save that waste Considerable opposition to this innovation has arisen among retailers and consumers The retailer contends that it is impossible for him to dispose of odd length material because of the common practice in the construction of wooden buildings claiming that the initial saving of the manufacturer is transferred to the consumer This is denied however because of the proportionally small amount of odd length material which will occur under the new system and because of the latter day practice of laying sub-floors of rough lumber and sheathing on the sides of the house before putting the finishing material in place. Because of the conservation element which enters into this question, the United States Forest Service has been recommending the adoption of odd lengths for some time past. The Portland office of the Service has recently made an investigation of the actual amount of unnecessary waste incident to the manufacture of even lengths only and these figures show that under the old system the refuse burner consumed about two per cent of the total amount of the important forms of planing-mill products which are manufactured from Douglas fir and other important forest species in the States of Oregon and Washington When it is considered that about 750 000 000 feet of planing mill products are manufactured annually in the two States mentioned above this two per cent assumes important proportions The Forest Service is authority for the statement that 15 000 000 board feet of high-price lumber can be saved annually in Oregon and Washington by the manufacture of planing-mill products into lengths of odd feet as well as even It would require the yearly growth of timber on approximately 30 000 acres of average timber land to produce the amount of lumber which this annual waste represents The manufacturer is convinced that the waste is unnecessary His greatest trouble now lies with a similar conviction on the part of the consumer that odd lengths can be used as economically as even lengths

The new Mexican Pan American Railway has already been opened states the American Machinist and the line is in active operation from San Jeronimo on the Tehuantepec Railway to Tapachula in Chiapas. The extension of that line will be continued to Port San Benito on the Pacific coast There is also planned a new railway passing through parts of the States of Coahuila and Chihuahua, about 375 miles long

MECHANICAL BOWLING MACHINE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

Numerous efforts have been made from time to time to devise a mechanical apparatus for reproducing human action in the delivery of a ball in various games where such is required such as baseball cricket tennis and so forth The problem however is somewhat abstruse inasmuch as in bowling success is largely dependent upon the brains of the bowler who resorts to varying subterfuges to nonplus his opponent such as varying the pace swerve and break of the ball while in the air or after it has struck the ground To reproduce these peculiarities by mechanical effort is no easy matter but an English engineer Mr D D Fsson M I M E of Birmingham has perfected an ingenious device for fulfilling the desired purpose

As may be seen the apparatus comprises a tripod of steel tubing firmly fixed to the ground by means of specially designed anchors which correspond to the body of the bowler The ball rests freely in a semi spherical cup or hand carried at the outer end of a lever about the length of the human arm with which it corresponds the lower end of this lever being pivoted to the body at the shoulder

When the machine is at rest the arm remains in a vertical position and the bowling operation is produced by pressing this arm backward into a horizontal position with the ball resting in the cup-shaped hand Directly the arm is released it flies toward its normal position describing therein a quarter of a circle the ball being propelled through the air with varying velocity as desired toward its objective This forward movement of the moving arm is produced by the action of a strong spiral spring one end of which is attached to the moving lever a short distance above the shoulder while the other end is attached to the body by an adjustable tightening screw By means of this screw the momentum imparted to the arm and consequently the velocity of the ball can be regulated merely by altering the tension of the spiral spring.

A ball delivered in this manner though fast or slow according to variation of spring tension is a straight-forward delivery—it possesses none of that swerve spin or gyration causing it to break to the right or left when coming into contact with the ground and which is so baffling to the batsman This requirement is fulfilled in an ingenious manner The center of the cup-shaped receptacle or palm of the mechanical hand has a roller or drum with its axis running transversely with the bottom of the cup and having its periphery projecting slightly above the spherical surface of the palm so that when the ball is inserted it rests upon this drum The cup itself is fixed into a box-shaped casting of such dimensions that the external diameter of the cup will fit against the four internal sides of its containing box. Attached to the base of this outer box and at right angles therewith is a hollow spindle or tube mounted on a bearing which is rigid with the end of the arm and in which it can be revolved. It will be observed, however that the axle on which the drum revolves is at right angles with the hollow spindle on which the box and cup are mounted the spindle itself being set at right angles with the ball's trajectory This spindle has a groove over which passes a band the ends of which lead down a recess in the arm to within a short distance of its pivot with the body and then the band is carried at a tangent over guide pulleys one on each side, and the ends looped to brackets on either side sufficiently far apart to enable the arm to swing [illegible].

When the arm is [illegible] from the [illegible] position [illegible] is [illegible] forward [illegible] the hand, by reason of the [illegible] [illegible] [illegible] [illegible]

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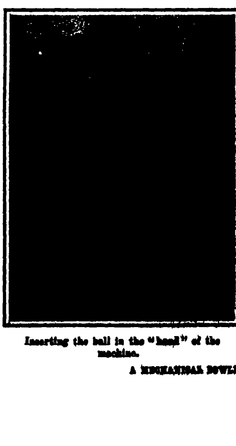
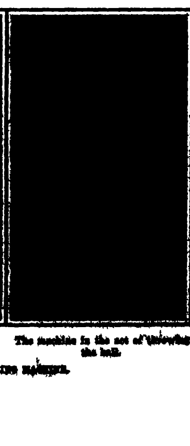


Inserting the ball in the "hand" of the machine.



The machine in the act of throwing the ball.

A MECHANICAL BOWLING MACHINE.

AN AUTOMATIC RAILWAY SAFETY STOP.

BY DR. ALFRED GRADENWITZ

Since the terrible catastrophe on the Berlin Elevated and Underground Railway caused by a train running by a stopping signal, the German railway administrations have been giving increased attention to automatic braking devices for preventing the recurrence of such accidents. The apparatus illustrated in the accompanying figures has been adopted provisionally, and is now being tested out. Its object is to warn the engineer and fireman by visible and sound signals and set the brakes, all being done simultaneously

The safety device consists of contact levers mounted on the locomotive, and pedal contacts arranged on the track. The former are always arranged on the right-hand side of the engine, and are actuated by a permanently tightened spiral spring. In the interior of the cab is arranged in a conspicuous position the repeating box, which is intended for indicating to the driver (1) whether the track is disengaged, (2) which signal has been passed over, or (3) that the apparatus is out of order, the various indications being signaled on a red background inside a white frame, immediately before the engineer's eyes.

Above this repeating box is arranged a recording box, which mainly contains a clockwork, which is actuated if the train runs by some signal. This clockwork sets a roller and paper tape rotating and thus causes a dash or dot to be inscribed. Furthermore, the engine driver is free to produce, on the same paper tape, before passing the signal, an annular mark, showing the signal to have been duly attended to These marks may serve as useful records in the case of law-suits.

On the roof of the driver's stand is mounted an alarm siren, the howling sound of which is readily distinguished from that of ordinary locomotive whistles. The same siren is used as a braking signal in the case of brakeless goods trains. On the running board of the locomotive is arranged the brake-cock casing 5, containing, in addition to the brake-cock, a click for tightening the spring above mentioned, and, accordingly, the whole apparatus. This click, in turn, is connected through the draw-bar 10 with the contact levers 6. These two contact levers 6 on sliding over the contacts pull downward the draw-bar 10 and thus set the apparatus working. The apparatus is actuated only in the event of both levers being struck simultaneously. This arrangement thus insures thorough reliability of operation

At each distant signal there is arranged a single pair of track contacts, and at the main signal, two pairs, situated about 30 meters apart They are so connected with the signals as to be lifted when the signal is closed, thus protruding beyond the rail head and coming into contact with the sliding levers of the locomotive, whereas, in the event of the signal being drawn, they are located below the rail head, so as to avoid any contact.

In addition to these stationary pedals movable pedals are provided which are readily fitted behind fish plates, with a view to warn and stop trains at any point of the track

The working of the apparatus is as follows On the contact levers passing over the track contacts, the draw bar 10 is pulled down, thus disengaging the click. The apparatus is merely operated by the spiral spring, and as the contact levers perform no work outside of disengaging the tightening apparatus, any heavy shocks are prevented, and the wear and tear is reduced considerably

On passing over a distant signal, the contact levers strike only a single pair of pedals situated on the track, thus closing an electric circuit, by the action of which the alarm siren is sounded, while a disk bearing the inscription "distant signal" appears in the cab signal box and a dash is marked on the paper tape in the repeating box The brake cock is opened at the same time and the train is stopped automatically Owing to the automatic disengagement of the brakes, the driver is in a position himself to throw the apparatus out of gear, and to continue his journey

On a closed main signal being passed over, the contact with the first pair of pedals produces an effect, as above stated, during a very short time which effect is reinforced immediately by the second pair of track contacts In fact, this second contact further disengages the click, thus opening completely the braking cock and producing a rapid braking At the repeating box appears a disk with the inscription "main signal," while at the same time a dot is marked in the recording box In addition to this, a checking lead is broken The second contact also causes the apparatus to become locked up, so that the engine driver is no longer in a position himself to throw the apparatus out of gear, before the train guard has re-

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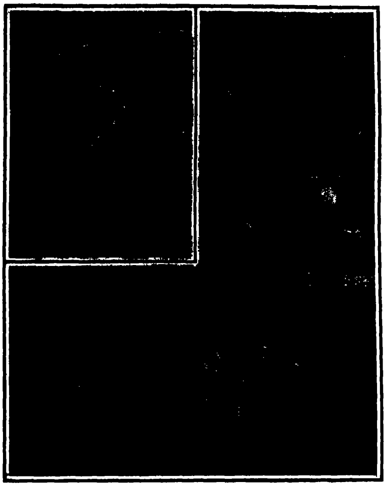


Upper engraving shows contact apparatus in operation The lower engraving shows contact of single lever without effect.

Tripping devices in operation.

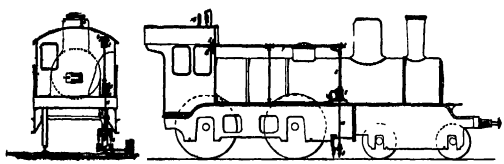
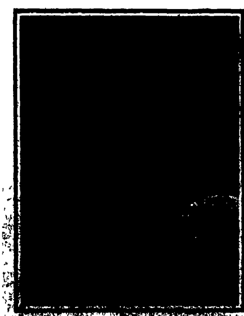
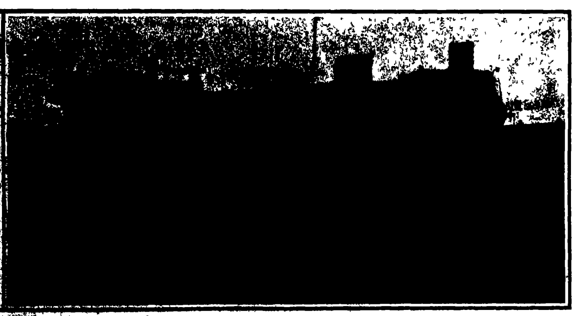


Diagram showing arrangement of track and engine contacts, and connections to sight and sound warning devices in cab





If the engine runs past a danger signal, track contacts display a signal in the cab and blow a warning whistle.

Express locomotive fitted with automatic safety devices.

AN AUTOMATIC RAILWAY SAFETY STOP.

FRICTION AT RAILWAY CURVES.

BY J. F. SPRINGER.

When two material surfaces are in contact with each other, there are two distinct methods of withdrawing points of contact from each other. Consider such points to be extremely small plane areas. Thus, let Fig 1 represent a highly magnified sectional view of two contacting points. *AB* represents the infinitesimal plane area. (First) The surfaces may be withdrawn from each other by moving *C* or *D* (or both simultaneously) in a direction perpendicular to the plane represented by *AB*. This gives rise to what is termed *rolling friction*. (Second) Withdrawal may be effected by moving *C* or *D* (or both simultaneously) in any one of the directions lying in the plane represented by *AB*. Thus, the movement may be along *AB*. The direction is immaterial, provided it is in the tiny plane of contact. This method of withdrawal gives rise to *sliding friction*.

Now material surfaces are not perfectly smooth. When in contact under pressure, the projecting particles interlock with each other—as idealized in Fig 2. It can readily be seen that movement in the directions *G H* would tend to shear off the large projections 1, 2, 3 4, while movement in the directions *E*, *F* would tend to shear off merely the interlocking protuberances of the large projections. That is to say, sliding friction involves abrasion of the principal projections, while rolling friction relates merely to projections on projections. Consequently, it is not difficult to comprehend that sliding and rolling frictions belong to different orders of magnitude. In fact, the one kind of friction is a most important consideration in mechanical engineering, while the other is usually negligible.

It is easily seen that the movement along *AB* produces what we all understand by sliding friction, but perhaps some may hesitate at considering perpendicular withdrawal as rolling friction. Consider Fig 3. Here the wheel is rolled in the direction given by the arrow *C*. The removal of the points contacting at *A* is effected by the change of the instantaneous center of rotation from *AA'* to the next point *BB'*. [See article "Some Principles of Ball Bearing Design" in Scientific American for November 6th, 1909.] In making this change, *A* moves perpendicularly away from *A'*. Likewise *B* approaches *B'* perpendicularly. And so on throughout the roll—the points of contact approach and recede from each other perpendicularly to the surfaces of contact.

Now it will not be very hard to see that any movement of withdrawal that is *oblique* is really a compound of the perpendicular and parallel movements. We may provisionally assume that in so far as it is perpendicular it is a rolling friction, and that in so far as it is parallel it is a sliding one. That there are such compound frictions may be seen by consulting the article to which reference has already been made.

Now two very important economic questions arise in connection with friction. First, friction *wears* the contacting parts. This is a matter of very considerable significance. Second, friction consumes *power* in performing this abrasion. In some cases, this becomes a matter of still greater importance. However, they go hand in hand—useless destruction of material and waste of the power used in accomplishing this destruction.

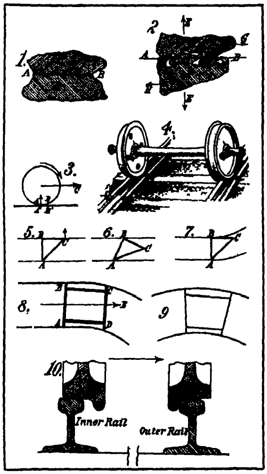
These two factors have, perhaps, been more or less recognized almost from the beginning of the age of machinery. But it is only in comparatively recent years that their vital importance has begun to come to the fore. In every direction in the machine world this is testified to at the present time by the introduction of ball and roller bearings. These serve—with more or less perfection—to accomplish the exchange of sliding for rolling friction. In the railway world, the antifriction movement is attested by the fact that large outlays are being made to eliminate the friction at curves. Reduction of time is no doubt also in view. But the railroads certainly have in view the economic gain to be derived from the avoidance of that excessive wear on rail and wheel which occurs when rounding a curve, and the money advantage in saving the steam power wasted in effecting the wear and tear.

That railway curves give rise to a very excessive amount of friction may be understood from the amount of wear occurring at a certain curve in the "subway" of the Boston Elevated Railway. Carbon-steel rails were replaced at a certain point, on the average, every forty four days. The amount of wearing down on the heads of these rails was about three-quarters of an inch. As to what happened to the wheels in accomplishing this wear, no one has any exact information. But it must have been very considerable. Three-quarters of an inch was not worn off the rail head without a corresponding effect on the wheels and trucks.

What happened at this curve is happening, in greater or less degree, upon all curves, wherever located. It is a matter of interest and importance, then, to consider more particularly the causes of friction at railway curves.

Three prominent factors enter. The first causal factor arises out of two facts. The outer rail of a curved track is longer than the inner one. And yet the one must be covered in the same time as the other. Then car wheels and axles are so combined that two wheels and the corresponding axle operate as a single piece. Consequently, the one wheel is compelled to rotate at precisely the same speed as the other. In rounding a curve, however, a greater distance is covered by the one. This conflict of rotational velocities between the two wheels results in slippage, and this of course means wear of metal and loss of power. It is to be observed that this friction occurs irrespective of the speed of the train. For the difference in length of rail between the two sides of the track remains precisely the same, and this controls the amount of slippage. The seriousness of the friction is accentuated, however, by the speed.

It has been proposed so to arrange the wheels and axle that this slippage could not occur. This might be done in two ways. Both wheels might be rotatably mounted, the axle being kept "dead"; or, the one wheel might be made integral with the axle, and the other rotatably mounted. That either method would be effective can scarcely be doubted, but practical railroad people do not seem to take kindly to wheels mounted rotatably on an axle.



FRICTION AT RAILWAY CURVES.

Whether they are justified or not, there is another friction factor which enters and which is of far greater weight. In order to get this clearly before the mind it will be well, perhaps, to consider the action of a group of flanged wheels on a railway track. Suppose we take a single pair of wheels and the corresponding axle. These wheels are flanged on the inside, as in Fig. 4. Now it will readily be granted that the axle must be kept perpendicular to the direction of the rails. In the case of the single pair of wheels, how will this be maintained? The two planes of the flanges at the places of contact with the inside of the head of the rail no doubt give some assistance. But this is practically negligible for the reason that a tight fit is not permissible. In fact, a very slight disturbance would be competent to destroy the perpendicularity of the axle, even on a straight track.

Consequently, some additional means must be utilised. If we attempt to solve this problem by constructing a truck of *three* wheels, all being maintained unalterable in their relative position to each other, we should not succeed. In Fig. 5, the triangle *ABC* represents such an arrangement, the wheel contacts being supposed to be at the vertices *A*, *B*, and *C*. This truck would no doubt withstand any tendency operating to throw it in the direction of the arrow at *C*. But a tendency in the opposite direction would give rise to the situation in Fig. 6. If at no other time, such a tendency would arise at a curve in the track when the rail corresponding to *BC* tended away from the truck as a whole. This condition of affairs is represented in Fig. 7.

The lowest number of wheels which when combined in a truck are competent to maintain themselves upon a track is *four*. The four-wheeled truck is consequently the unit that must be dealt with in considering the friction arising at curves.

Now when such a truck rounds a curve, the outer wheel of the forward axle is the one which first meets the change of direction. This is shown in Fig. 8, where the wheel at *C* has begun to respond to the curvature. The wheel at *D*, because the rail curves away from it, will tend to be relieved. The impetus of the truck is in the direction *B*. Consequently, there is a severe grind at *C*. And this condition obtains throughout the curve.

No doubt if, during the time of rounding the curve, the axles of the truck could always lie in radii of the curve, as shown in Fig 9, the friction arising from the rigidity of the truck formation would be largely reduced, if not entirely eliminated. Inventors seeking to attack this problem must remember that the arrangement of the truck cannot be flexible. The change from the rectangular form to that of the isosceles trapezoid must be sufficiently instantaneous. It must not go further than requirements demand. Further, conditions must be reversible for curves bending in the opposite direction. Altogether, this is a very pretty problem.

Another factor which enters is one pointed out by Mr Edward Godfrey. The tread of the wheel is not horizontal, but inclined, as in Fig. 10. On the outside wheel of the forward axle the climbing tendency resulting from the effort of the truck to move in a straight line forces the wheel flange to some such position as that shown in the figure. This is aided, no doubt, by the fact that thus greater speed is attained. Reverse conditions on the inner side of the curve cooperate to the slewing of the whole axle outward, because thus a less speed is obtained on the inner side of the truck. Now the result of this slewing is to bring a very steep portion of the outer wheel in contact with the head of the rail. There arises, thus, a severe wedge action. This is, perhaps, the most important of all the factors giving rise to friction at curves. It is due to a combination of the causes producing the other two.

Death of William A. Eddy.

William A Eddy, well known throughout the country for his many kite-flying experiments, died recently after an illness of several months. Mr Eddy's life was spent in the study of kite flying, to which art he contributed much that is valuable. Although a self-taught man, he did much useful work, particularly in kite photography. Latterly he was very much interested in aeronautics, to which his kite investigations naturally drew him.

Dr. Czerkis of Vienna, who has undertaken a study of the chemical structure of cannabinol, the active principle of hashish or Indian hemp, gives the following graphic description of the peculiar intoxication which hashish produces. "It is as if the sun illuminated every thought that passes through the brain, and every bodily movement is a source of joy. The hashish eater does not experience the kind of pleasure which is produced by the gratification of bodily appetites. He feels the joy of one who hears good news, of the miser counting his gold, of the lucky gambler, or the successful seeker after fame. He is the sport of every impulse and the current of his thought is diverted by the slightest impression. A word or a gesture suffices to suggest new images and ideas, with marvelous quickness and precision. For this reason the Oriental hashish eater, before he gives himself up to the enjoyment of the drug, takes care to remove from his presence everything that could induce melancholy or any feeling except that of keen delight. For the accomplishment of this object he makes use of every means which the customs of the Orient place at his disposal. In his harem, surrounded by his wives, under the spell of soft music and voluptuous dances, he enjoys a delirium in which he feels himself transported to the paradise which the prophet has prepared for him."

THE WIND OF AN AEROPLANE PROPELLER.

The idea of propelling a huge machine weighing half a ton at the speed of an express train by means of a fan seems absurd on the face of it. One is apt to discount the power of a fan Air is such an intangible, imponderable, substanceless fluid, that it seems impossible to obtain sufficient thrust against it to drive a machine of any appreciable weight. Yet this is what a flying machine propeller must do. The result is obtained by making the propeller of such size and driving it at such speed that when the machine is held stationary, the propeller will generate a current of air flowing at the rate of a hurricane. We know something about the power of heavy gales, and when we consider that an aeroplane propeller is capable of producing a moderate-sized cyclone, it is easier to conceive of its exerting sufficient force to drive a 1,000-pound aeroplane at a fast clip Flying machines have attained a speed of over fifty miles per hour In order to do this, the propellers must have been driven fast enough to have produced a current of air considerably more than this velocity, because the fluidity and elasticity of the air is sufficient to cause a considerable "slip" of the propellers, which reduces their efficiency to a large extent, depending upon the design of the propeller Our front-page illustration this week shows Mr. Hubert Latham's "Antoinette" monoplane under going a test of its propeller The propeller is revolving at the rate of about 1,100 revolutions per minute, which is about the rate of the average electric fan, but when we consider that the propeller describes a circle 6¼ feet in diameter, some idea of the volume of air set in motion by the machine can be conceived At a test made in England last fall, a thrust of 265 pounds was obtained Supposing the motor to develop only 30 horse-power instead of the 50 at which it is rated, this is equivalent to but 8.8 pounds per horse-power, which is about all the average propeller will give. A prominent American experimenter has lately obtained 325 pounds thrust with a 30-horse-power motor, but in this instance a large 9-foot propeller making but 400 R. P M was used Such a propeller is more efficient and produces a greater thrust per horse-power In the instance cited it was also of a special form. The illustration shows Mr Farman at one side of the machine, and Mr Curtiss at the other It is curious to note that the hazy circle produced by the rapidly rotating propeller is cut at two points by wide dark bands. These are shadows cast on the blades The shadows are, of course, intermittent, as they fall upon the blades only as they come within the range of the shadows This suggests an experiment which was submitted to us some time ago by one of the readers of the Scientific American He proposed to show the shadow of a man on a string The proposition appeared rather startling, but he soon demonstrated that the complete shadow, showing a perfect profile of the man's face, could be shown on the string, provided the string were weighted at one end and whirled around so that it formed a hazy patch of reflected light similar to that produced by the propeller blades in our front page illustration The persistence of vision of course accounts for the haze in the first place and for the shadow as well, because both are intermittent, as an instantaneous photograph would show

The Public Bath System of New York City.

In a paper presented before Section 1 of the American Association for the Advancement of Science, at the Boston meeting, December 28th, 1909, entitled "The Public Bath System of New York City," by William H. Hale, Ph D, Superintendent of Public Baths of Brooklyn borough of New York city, some interesting facts were stated showing the increase and utility of this recent public institution for the promotion of the public health

Prior to the consolidation of the surrounding cities into Greater New York there was no interior public bath. All were located along the river front as floating baths. The first interior public bath in Manhattan borough was established on Rivington Street on the east side of the city March 23rd, 1901, and has been the most crowded of any bath, on the average, for the year.

Newer baths opened on Pitkin and Montrose Avenues, Brooklyn borough, have had more bathers in hot weather than any others. It is stated that on one hot summer day 9,000 bathers used them. A third public bath was opened in Manhattan on November 23rd, 1904, in West 41st Street. At the present time there are seven in Brooklyn, twelve in Manhattan, and one each in the boroughs of Queens and Bronx. In the Brooklyn borough during 1908, 2,036,825 persons patronized their five interior public baths. In 1909, up to December 1st, 2,372,752 persons used all the baths in this borough, showing an increase over the previous year.

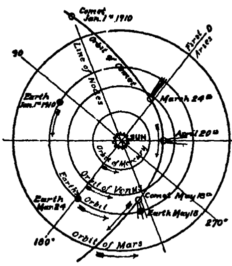
In Brooklyn a small charge is made, 1 cent for a cake of soap and 1 cent for a towel, and an additional charge of 2 cents for the use of a tub bath. The free baths are mostly of the shower kind, although in some later bath houses swimming pools have been built sixty feet long by thirty-nine feet wide, said to be the largest in the city Newer bath houses have a gymnasium built in the second story above the bath house proper. This has been found to be a most useful adjunct. Mr Hale suggested still further that roof gardens be built above the gymnasium He also recommended that there should be a greater extension of facilities for public bathing, particularly the establishment of a great public bath by the sea modeled after the baths at Revere Beach and Manhasset Beach in Massachusetts. At Coney Island on city property such public bath structures could be constructed as would be remunerative to the city and yet would supply a pressing public want. Mr Hale further recommends the establishment of a separate bureau of public baths and gymnasiums, with uniform pay to attendants and officers, to cover the whole city The city should have full control of the proposed seaside baths, as they are intended for the entire city and not wholly for the borough in which they are located

RELATIVE POSITIONS OF HALLEY'S COMET, THE EARTH, AND THE SUN

BY JOHN C DEAN

At the top of the accompanying drawing the comet is shown in its position for January 1st, 1910, outside of the orbit of Mars At the left the earth is moving in its orbit away from the comet, the distance between them being about 115 million miles

On March 24th the earth will reach the position shown in the drawing, while the comet will have moved to a point on the opposite side of the sun During this period (January 1st to March 24th) the comet will be visible, with the telescope, in the western evening sky, but on March 24th, when passing back



RELATIVE POSITIONS OF HALLEY'S COMET, THE EARTH, AND THE SUN.

of the sun, will be invisible for several days The distance between the earth and comet at this time will be 165,000,000 miles

When the comet next emerges from the rays of the sun it will have shifted to the morning sky, rising before dawn, and for the first time becoming an interesting object to the naked-eye observer The earth and comet will now rapidly approach each other and the latter will greatly increase in brilliancy

About April 20th it will pass its nearest point to the sun, as shown in the drawing, and on May 18th will again disappear in the sun's rays—this time, however, passing in the front of the great luminary It is predicted that the nucleus will cross the sun's disk about five minutes of a degree from its center, thus furnishing an opportunity to observe whether the nucleus is opaque to the sun's rays.

The transit will not be visible in the United States as it will occur after sunset here

On the night of May 18th the earth and comet will rush past each other and the earth will probably sweep through the tail of the comet. They will be only 12,000,000 miles apart. After May 18th the comet will attain its maximum of splendor in the evening sky, and in a few days thereafter its glory will rapidly fade.

The Current Supplement.

Dr Alfred Gradenwitz opens the current Supplement, No 1775, with an article on a snow plow employed on a Swiss railway Some interesting information on submarine sound signals is presented Mr Warren O. Rogers writes exhaustively on friction drums and brakes. The employment of electrolysis in chemical manufactures is made the subject of an instructive article by Prof. B. Lepsius. Mr Charles R. King describes a new gas fusion process. One of the most important questions in connection with aerial navigation is the provision of suitable places of refuge for the enormous dirigible balloons of which Germany is the proud possessor The problem is discussed in a copiously illustrated article by our German aeronautic correspondent. Dr Robert Amory writes on coffee as a beverage and describes a new method of preparing it for the table The great guano deposits of Peru are described and illustrated Dr L H Baekeland summarizes the electrical and electrochemical applications of bakelite

Correspondence.

THE END OF THE "DANIEL TENNEY"

To the Editor of the Scientific American

In looking over some old files of the Scientific American to-day, I found in the issue of March 13th, 1897, reference of the building of the old merchant ship "Daniel I Tenney," built at Newburyport, Mass, by John J Courier, Jr

This item, in connection with the storm now raging, carries me back to eleven years ago to-day, when the "Daniel I Tenney" was lost off the coast of Scituate, in the disastrous November gale The wreckage was strewn for miles along the shores of Scituate and Marshfield A portion of the stern containing the name was thrown ashore opposite the writer's house I picked up some of the interior finish of the cabin, and have made several pieces of furniture of it, which are prized quite highly by the owners This is the sad ending of the career of that noble ship which so proudly braved the storms of old ocean so many years.

Perhaps some of your readers may be interested to know where the "Daniel I Tenney" laid her bones to rest.

W W Randall.

Sea View, Mass.

THE INVENTOR OF THE STEAMBOAT

To the Editor of the Scientific American

I beg to thank you for publishing my letter, as also for your courtesy in sending me the copies of your current issue

I wish to point out that although I insist that it would be a most difficult matter to prove that any other of the so-called inventors have any just claim to priority, yet if any reliable proof of any "inventor" having produced a practically successful steamboat prior to 1736 is available, then I would once for all sink any claim on behalf of Jonathan Hulls, but in my humble opinion, from research I have made upon the subject, such is not possible Therefore I boldly assert that he and he alone should have the great honors ascribed to him Will anyone refute this?

I claim practical success of his invention, but not commercial success, and to do justice to an inventor's memory, it should not be for the purpose of requiring commercial success He laid the foundation for commercial success- this fact is undeniable, therefore why should he not have the honors and distinction for his genius? Always remembering that he was many years ahead of his competitors

I do not admit, what is so generally claimed, that it is not the man who invents, as the man who puts into actual practice, that is deserving of the honors. Without the man who invents, there could not be any need Neither would he have any place for putting into practice that which he would otherwise have had no knowledge of, had it not been for the earlier inventors

It appears clear that Jonathan Hulls, although the side-paddle boat had existed for many years propelled by both manual and animal labor, yet he was absolutely the first to suggest steam power to supersede both methods by steam propulsion And with his original innovation of the stern wheeler combined with the side paddles, his claim to originality is made doubly sure, always remembering the very early date of his invention and the very crude form of steam engine which then existed Therefore the greater the honor that should be accorded to him

With regard to Fulton, no serious claim can stand in face of the foregoing To put it mildly he was only a copyist in the matter of steam propulsion I cannot too forcibly assert that Robert Fulton has no claim whatever, and this fact N S Arthur Daniel corroborates This gentleman asserts that "England should certainly set up a monument for Jonathan Hulls, as he was undoubtedly the original inventor in England", and he further states "whether he actually built the boat or not is of no special consequence"

I have been able to provide proof that he did build his boat, and that it was a practical success Consequently, any additional proofs I have supporting him —and they are numerous—would be quite superfluous.

There could not possibly be more than one inventor of steam navigation, whatever adjectives be used

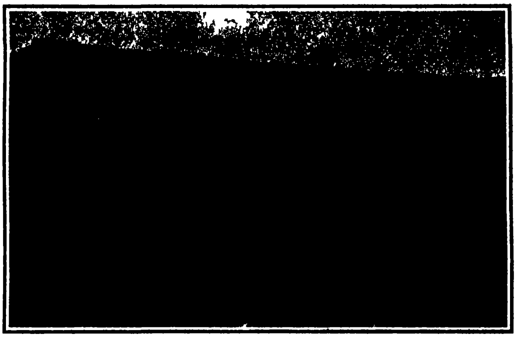
J Hooper Hulls

Manor Park, Essex, England

GLASS ESPALIER WALLS.

BY JACQUES BOYER

In the cultivation of fruits on the espalier system the trees and vines are planted along a wall of stone or brick to whi h all their branches are arefully attached so as to spread them out into a plane sur fa e an l allow free ac ess of light and air to every part Ordinarily the dire tion of the wall is deter ined by local circumstances and he varieties of pears herries ı aches apricots apples and other f uits whi h are ı lanted along the wall are selected with refer nce to his di rection Until very recently if the wall was built in an east and west direction so as to expose one face to the south the other face was almost ı tirely wasted In order to remedy this state of af fairs several fr it grow ers have conceived the idea of employing transparent espalier walls through which the light of the sun can penetrate to the trees planted on the north side of the wall Comte Horace de Choiseul in particular has conduct ed a series of very inter esting experiments of this sort on his estate at Viry Chatillon in the Depart ment of Seine-et Oise and has obtained some very promising results He built a glass wall 6½ feet high and about 60 feet long extending in an east and west dire tion and planted fifteen pear trees of the variety Winter Doyen on ea h side north and south Th bearing surface of the wall amounted to abo ıt 26 squar yards on each side The south side yielded 134 pears of a total weight of 91 pounds and the north side bore 119 pears weighing 77 pounds making in all 243 pears with an aggregate weight of 168 pounds All of the pears were of parti ularly fine aı pearance without blem ishes of any kind and it is a remarkable fact that the fruit which was gathered from the north face of the wall was even smoother of skin than that which was produced on the southern side Each square yard of the glass wall produced nine or ten pears of an aver age weight of about 11 ounces



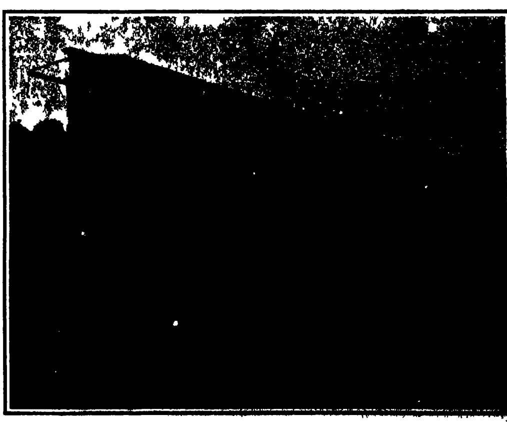
A GLASS ESPALIER WALL (SOUTH SIDE)

Another experiment with glass espalier walls has been made by MM Croux & Sons in their nursery at Val d Aulnay in the Department of the Seine The wall which they constr cted also lies east and west and consequently presents northern and southern ex posures As the ac om pai yiı g photographs show the wall is surmounted by a glazed roof projecting on each side Along ea h fa e of the wall were ı lanted Calville apples Winter Doyen Passe-Crassane and Directrer Alphand pears together with pea h trees and grape vines care being taken to place the same varieties on ea h side in order to ı ake the con parison easy a d a u rate

In 1907 these trees and vines produ ed their first crop in which no differ en e betw en the fruit produ d from the north and so th sides of the wall o ld be de e ted The same result as shown by th ro s of 1908 and 1909

There is indeed little diff rence in temperature between the north and south fa es as he former is heated by the solar rays whi h traverse the g ass and tl e latter is cooler than the so th side of a masonry wall for the very reason that some of the incident solar radi ation is transmitted through the glass and consequently less is reflected and absorbed This difference in absorbing power how ever makes the glass wall inferior to the masonry wall in the matter of warming the plants and protecting them from frost at night A masonry wall absorbs a great deal of heat during the day and gives it out at night but this effect is comparatively small in the case of a wall of glass

In the matter of cost there is little difference be- tween the glass ai d the masonry walls The cathedral glass e nployed by MM Croux costs about $6 or $7 per linear yard of wall 8 feet high including the cost of the glazed roof projecting over both sides A masonry wall of the same height would cost $4 or $5 a yard and the addition of the glazed roof which of course is equally necessary in this case would raise the total cost to $6 or $7 per linear yard More extensive and long continued experiments must be made however before it will be possible to pronounce a positive opin ion concerning the relative merits of glass and ma sonry espalier walls



A GLASS ESPALIER WALL (NORTH SIDE)

There is now a prospect of a thorough, explicit cen sus of the population of China To grasp what this signifies one must first remember that China is vastly the most populous state of the whole world and second ly that hitherto such estimates of the number of its inhabitants as have been published have fluctuated between 100 000 000 and 900 000 000 only Commonly at the present day the number of natives in China is mentioned as 400 to 450 millions, but expert geographers brand this number as greatly inflated. In many late books in consequence the reader finds only 300 to 350 or indeed only 250 millions stated as the probable extent of the population Naturally it occurs to the thinker that the importance of all suppositions in regard to a yellow peril and its directions must depend very largely on a sure calculation of the size of the population of China

Of course in the course of former centuries the Chinese government projected and made at least the semblance of various censuses so that when they were published they were found to be mostly mere statements of the approximate number of fam ilies and were therefore quite unreliable And the shadowy value of such censuses was not improved by the way by the chic anery of the governments of the individual prov inces who when a census was ordered for the purpose of military conscrip tion or of collection or application of a tax promptly falsified the figures

Now finally the gigan tic project of a real cen sus of the whole Chinese Empire is to be executed and in the double form of a census of families and a census of individuals The former is to be ready by the early part of 1910 the latter by 1912 In view of the immense extent of the Chinese Empire the vast ness of this task can hardly be overestimated The stupendous endeavor required by such a work can be s ıstained however by the present excellent organiza tion of the Empire though the fact cannot be ignored that certain parts of the Empire deem themselves wholly independent and will therefore resist the necessary official visitation required by the census in such districts or will try through the stiffest mendac ity possible to make the results of the census as far as they concern themselves utterly ridiculous

Despite the recognition of the inevitable effect of such uncertainties and defects however the definite attempt to make a careful census of the population of China would be of great value and even if the final published result of the double form of the census were not correct by 20 to 30 million individuals

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Concrete poles hexagonal in shape and hollow through the center are used by the Oklahoma Gas and Electric Company A 35-foot pole measures 7 inches across corners at the top and 16 inches across at the butt. They are molded in forms made up of 5-foot sections, so that it is possible to cast a pole of practically any length. Steel rods are placed symmetrically about the central axis and at the top and bottom project through holes in a steel plate. The rods are bent over at each end and are securely fastened. The [illegible]

GRAPHITE MINING IN CEYLON

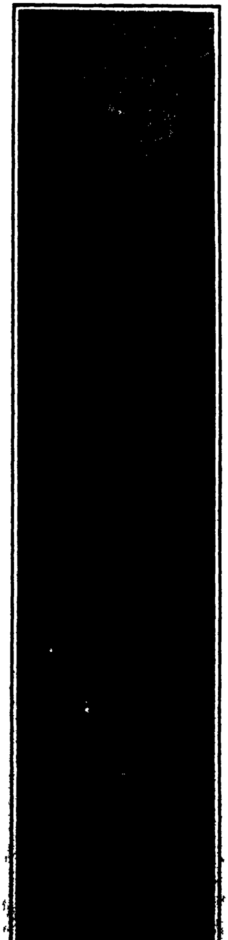
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

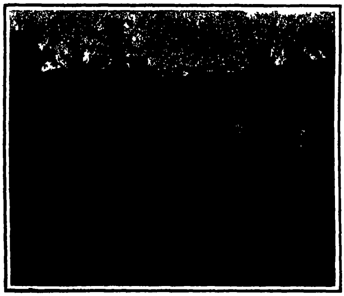
Among the various minerals found in the island of Ceylon, that which is the most abundant is graphite or plumbago, practically the only one found in sufficient quantity to render exploitation profitable It has attained a worldwide reputation for its excellent quality its composition being practically pure carbon and is in extensive demand for crucibles The average output is approximately 50 000 tons per annum the greater part of which is exported to Great Britain and the United States Within the past two decades the trade has undergone considerable expansion with the result that mining is being extensively developed

The mineral is found in veins and nests in the crystalline rocks occurring frequently in a fibrous or flaky form the flakes being disposed at right angles to the wall of the vein These veins vary in width sometimes being less than an eighth of an inch while in others they will extend to several feet Some are found to follow the foliation planes of the various rocks while others run crosswise or branch in all directions

As a rule in a series of shafts sunk close to one another it will be found that a single main vein or several parallel veins will extend through the whole of these pits with minor vanes stretching from either side along the planes of division Even if the mineral is not found in continuous veins but rather in isolated pockets or nests these are generally parallel to one of the main directions Investigations show that the mineral exists in a series of belts but their extension can

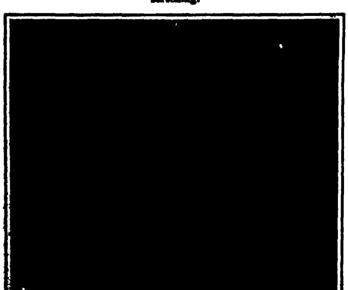
(Continued on page 96)



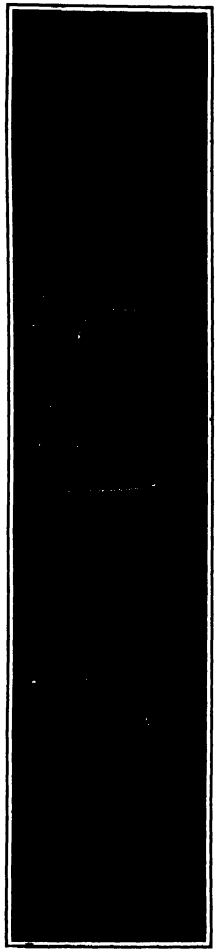


Sifting and screening the graphite.

Hand cleaning, sifting, and breaking large pieces of graphite after screening.

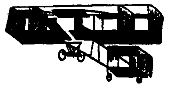


Final grading of graphite into first and second qualities and package for shipment.



Graphite pit, showing crude baling arrangements Baling is carried on by natives.

GRAPHITE MINING IN CEYLON.



RUFUS PORTER AND HIS "FLYING SHIP."

BY C. E. McCLUER.

Soon after the Montgolfiers invented their first "hot-air" balloon, which was almost immediately followed by the first "gas" balloon, the attention of scientists and inventors seems to have been centered on the spherical and elongated gas bag as a means of flotation, and the provision of propellers and rudders to enable the navigator to control the movements of the unwieldy and wind-tossed sphere, and produce what is now known and briefly described as a "dirigible" balloon. Omitting all reference to the work of the many accomplished and venturesome balloonists who originated or copied the various devices which they adopted for the guidance and management of their spherical or pear-shaped, or elongated and cigar-shaped gas envelopes, we will revert at once to the subject of our sketch.

Rufus Porter, belonging to that numerous class of ingenious New Englanders usually styled "Yankee inventors," was born at West Boxford, Mass., May 1st, 1792, and died in New Haven, Conn., August 13th, 1884. Although he received only a common district school education, he possessed an alert mind and a retentive memory, which, coupled with a natural genius for observation and invention, fitted him admirably for an active and useful life. He early displayed inventive abilities of no mean order, as is attested by the list of his patented inventions disclosed by the records of the Patent Office. Some of his patents displayed an acumen and foresight which led him into the van of progress, and proved that he was fully abreast if not actually ahead of his time. Among his numerous patented inventions we find enumerated a cord making machine, a steam carriage or ordinary road vehicle, prophetic of the latter day automobile, a pioneer treadmill horse power machine, a corn sheller, the inevitable Yankee churn, a washing machine, a signal telegraph, and a municipal fire-alarm system, the latter doubtless being the forerunner of the largely adopted and efficient Gamewell fire-alarm system, now so largely in vogue.

In 1840 we find Porter as editor of The New York Mechanic, the first purely scientific newspaper published in the United States. The next year it was removed to Boston and the title changed to The American Mechanic. In 1845, evidently not having made a pronounced success with the publication of The American Mechanic he returned to New York and began the publication of another journal which he styled "Scientific American, the Advocate of Industry and Enterprise, and Journal of Mechanical and Other Improvements," on a cash capital of $100. The first number of the new periodical was issued on the 28th day of August, 1845. After six months of struggle, with varying success, his journalistic enterprise was purchased by the present proprietors of the SCIENTIFIC AMERICAN.

Among Porter's less noticed inventions, and the one from which I presume he reaped the smallest recompense, was a flying machine, or as now styled, a "dirigible" balloon, but which he dubbed an "aeroport." As nearly as I can ascertain from the records at my command, this invention was made and patented in 1820, but not until 1852 did Porter seem to make any serious effort to exploit the device. In that year he organized what he called "The Aerial Navigation Company," and attempted to raise the funds necessary to enable him to construct his first aeroport by an appeal to popular support through the sale of $5 bonds or certificates.

Among the papers of my deceased father I have recently found one of these bonds, issued to him under date of April 28th, 1852, a facsimile of which is reprinted herewith.

Below follows an abbreviated copy of the "proposal tion and prospectus" alluded to in the bond, as I find it printed in the issue of the National Intelligencer of March 19th, 1852.

"THE FLYING SHIP"

"A chance to secure a cash income of $10 to $20 per week for twenty years by the investment of five dollars in advance.

"It is extensively known that the undersigned has by theory and practical experiments so fully demonstrated the practicability of aerial navigation that all who have fully examined the subject are convinced, and no person, even of those whose interests are adverse to its success, can offer a word of rational argument against it. Several model machines have been constructed, and each of them has operated successfully, and one of them, sixteen feet long, carried a small steam engine, by the power of which the machine was propelled, and, being guided by its own helm, travelled rapidly through the air, even against a breeze of wind, in direct lines or circles, according to the adjustment of its helm. This machine was witnessed and applauded by hundreds in New York and Boston and notices thereof were published in several newspapers of those cities at the time. Since those experiments were made the inventor has made additional improvements whereby the invention is now perfected. And it appears certain that a safe and durable aerial ship (or aeroport), capable of carrying one hundred and fifty passengers at a speed of ninety miles an hour, with more perfect safety than either steamboat or railroad cars, may be constructed for $15,000, and that the expense of running it will not exceed $25 per day. It is ascertained by a minute and careful estimate that an aeroport 150 feet long and capable of carrying five persons at a speed of sixty miles per hour, may be constructed for $1,500. Now, having been disappointed of the funds requisite to put this invention in operation on a scale of practical utility, I propose that if three hundred persons will subscribe five dollars each, payable when the whole amount of 1,500 dollars shall have been subscribed, I will forthwith construct this pioneer aeroport, (which may be done in six weeks), and when this is put in operation I can readily command the requisite funds for constructing a large aeroport as above mentioned. And I will so arrange that each subscriber on the payment of the said sum of five dollars, shall be furnished with a regular title deed, which shall entitle the holder thereof to one three-hundredth part of this first aeroport, and also to one three-thousandth part of the first large aeroport that shall be constructed, and of all benefits and emoluments that may be derived therefrom for twenty years, the said aeroport to be kept in repair without expense to the shareholders. . Washington, March 16th, 1852. Rufus Porter."

FACSIMILE OF THE AERIAL NAVIGATION COMPANY BOND WHICH SHOWS THE PORTER AEROPORT DIRIGIBLE CAR.

While with the added knowledge and experience of a half century we can see wherein Porter was mistaken in his calculations and visionary to a considerable degree, we can also see wherein he was in advance of his day and generation, and prepared to achieve the success that later and quite recently attended the efforts of Count Zeppelin and others of the present day, had he but been in possession of the gasoline or alcohol motor as now applied to dirigible balloons and aeroplanes. Comparing the fanciful representation of his aeroport as given by the engraving printed on the bond, one cannot help being struck with its resemblance to the modern dirigible balloon. While, without repeating Porter's calculations as to the capacity of his aeroport for tonnage and speed, I judge he was guilty of exaggeration, he certainly came mighty near the ideal conditions for a successful dirigible balloon with weight of engine, boiler, and cabin greatly reduced. What method he adopted for stiffening his gas cylinder in the absence of the metal, aluminium, as used by Count Zeppelin, is not disclosed, but it is quite possible an inspection of his patent might disclose some adequate provision for that purpose.

Rufus Porter is certainly entitled to all the credit attaching to the organization of his "airship" enterprise, and the exercise of his superior inventive faculties in connection with the science of aeronautics and as a pioneer in that department of human endeavor.

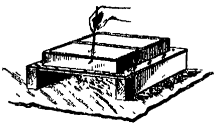
Handy Man's Laboratory

IMITATION MARBLE

BY A. J. JARMAN

A simple method of imitating marble with all its beautiful vein markings spots, and irregular lines and variable colors, is as follows

The skill in giving the veining, etc, to the product will be quickly attained by making a few small slabs in a plain way previous to undertaking the production of a larger number The colors for the veining must all be of a mineral character, as follows plumbago (black lead), chrome green (dark), common crocus,



IMITATION MARBLE

yellow ocher, red oxide of iron, and ultramarine blue Procure a few pieces of stout sheet glass, say 7 inches by 11 inches (an ordinary 11 x 14 photographic negative cleaned and cut in halves is just the thing) Make a wooden frame of ½ inch board, an inch deep with a division in the middle, simply held together with 1 inch iron brads not driven firmly in Leave an eighth of an inch projecting so that they can be easily withdrawn with a pair of pliers. Arrange these strips of wood, after being smoothly planed all over, so as to give two squares of five inches internal measurement.

Make up the following in a bottle Paraffin wax, ½ ounce, benzine, ½ pint Place this, well corked in a warm room to dissolve, aid this by shaking it occasionally When the paraffin is dissolved it is ready for use. Brush some of this preparation all over the inside of the wooden panel Then take a piece of Canton flannel or soft rag, wet it with the benzine mixture, rub this well all over the smooth side of the glass plate, polish it thoroughly with two pieces of soft rag until there appears to be nothing left and place the frame upon the glass plate Now lay a mirror, or a piece of plain silvered glass upon the work bench, or table, and place a block of wood at each end so that the glass plate and frame will rest about four inches above the mirror the frame being held in place by a couple of rubber bands Place a teaspoonful of chrome green in a small saucer and a teaspoonful of black lead in another saucer and add a dessertspoonful of water to each

Mix the following in any suitable vessel (a small stoneware pitcher being well suited) To ten ounces of water add sufficient plaster of Paris to make a mixture of the consistency of thick cream Skim off the air bubbles and any dust that may float on top, when in the course of a minute or two the plaster must be poured carefully into one side of the square on top of the glass plate. Fill this nearly half way. Pour the remaining portion into the other square. Now dip a small brush into the moistened black lead, press it through the soft plaster and paint the plain or zig-zag veining or spots. The plaster blends beautifully with the color and the mirror enables one to see the effects produced. Any line made too strong or lumpy in appearance can easily be rectified by a light stroke of the brush Green streaks or veins may be painted with the same brush after washing it quickly and dipping it into the chrome green. Treat the other square in the same way.

Having now produced the veining, the block may be reinforced as follows; Have ready to hand a few pieces of galvanized iron netting. Cut a piece 4½ inches square with a quarter of an inch or three-eighths of an inch mesh. Bend up the wire ends and lay the piece down upon the plaster with rough ends sticking up. In the same pitcher that the plaster was mixed shake up about the same quantity of Portland cement. Pour in the water first and then add the cement, a small quantity at a time, pour the mixture upon the plaster and wire netting until the panel is filled. Treat the second square in the same way, allow the whole to stand for an hour, until both plaster and cement have become quite set. As soon as all has become well set, draw out the brads with a pair of pliers and remove the woodwork carefully This will hasten the drying Take care not to shift the cast blocks upon the glass plate Let them become quite dry while in contact. When dry the colors will not be more than one-third as brilliant as when wet, the effect being precisely like marble The face of these blocks will possess very smooth surfaces with only a partial gloss upon them, being at the same time porous The porosity can be stopped and the gloss much improved by the use of amylacetate collodion This is practically a solution of gun cotton in amylacetate which not only fills the pores of the plaster, but forms a coating as clear and transparent as water It resists the action of weak acids and alkalies and can be washed with water and a chamois leather at any time without injury to the object it covers

When the squares are perfectly dry and slightly warm they must be placed in a plate or large saucer, containing a mixture of amylacetate collodion and one-third amylacetate This thin collodion will penetrate the pores of the plaster for a quarter of an inch or more in a short time Remove the square and stand on one corner to dry in a warm place When dry a coating of the thick amylacetate collodion may be brushed upon the surface and allowed to drain from the opposite corner The surface will improve in brightness with every coating Amylacetate collodion costs about two dollars per gallon at any wholesale chemists. A gallon will go a long way in waterproofing such slabs of imitation marble as here described

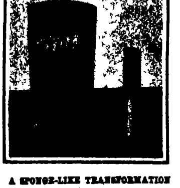
A much harder material with a slight grain can be produced by mixing a small quantity of ground pumice or ground glass with the plaster which must be intimately mixed to insure uniformity This mixture is sometimes termed Parian cement Imitation marble blocks can be made by the above process into any shape such as a keystone for a mantelpiece or circular with an inlaid border and in many other ways that will suit the taste of the individual worker In place of Portland cement, Parian cement may be used as described above, thus producing a slab of an almost uniform color Any size of slab may be made as described Of course the thickness must increase with the size of the slab to give strength

SOME CURIOUS CHEMICAL GROWTHS

BY ALFRED P. MORGAN

The following experiments are somewhat out of the ordinary but may be performed with the materials at hand in any chemical laboratory, or obtainable at a well-stocked drug store

In the first experiment mercury is prepared by throwing into it small pieces of clean metallic sodium The sodium will almost immediately take fire and leave a hard crust on the surface of the mercury Break this crust with a glass rod and stir it in the mercury until it dissolves The little pill bottle on the right in the illustration contains five cubic centimeters of mercury having sodium dissolved in it The tumbler on the left shows five cubic centimeters transformed into 'ammonium amalgam,' and occupying a space over fifty times the original volume of the mercury The transformation was brought about by throwing the mercury into a tumbler containing a strong solution of sal ammoniac in water The mercury immediately swells up into a spongy mass. The time elapsing between the moment when the sodium amalgam was thrown into ammonium chloride and the taking of the photograph illustrated here was about thirty seconds.



A SPONGE-LIKE TRANSFORMATION OF MERCURY.

PLANT-LIKE GROWTHS DUE TO OSMOTIC PRESSURE.

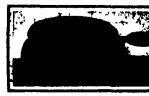
The reaction may be represented as follows "(Na dissolved in Hg) and NH_4Cl = (NH_4 dissolved in Hg) + NaCl.

Upon examination of the mass, it is seen to be very spongy in nature, and its growth in all probability caused by the evolution of a gas. This is indeed the true explanation of the phenomenon The NH_4 of the ammonium chloride dissolves in the mercury but soon the mass decomposes, and bubbles of ammonia and hydrogen gas cause the enlargement.

In a few moments the mass will begin to sink, and a strong smell of ammonia will be noticeable If a lighted match is held over the small bubbles arising from the liquid, they will burn, lighting with the "pop" indicative of hydrogen The mercury will soon return to its normal condition, in accordance with the following equation

$$2\ NH_4 \text{ dissolved in } Hg = 2\ NH_3 + H_2 + Hg$$

There can be no doubt that the NH_4 is actually present in solution in the mercury, for when a salt of ammonium is decomposed by electrolysis, the NH_4 ion upon its discharge gives ammonia and hydrogen and no NH_4 is formed But if a pool of mercury is used as the negative electrode the NH_4 dissolves in the mercury and forms an amalgam with it However, during the formation it swells up and gives off the products mentioned above



GROWTH OF ALUMINIUM OXIDE ON A TELEPHONE RECEIVER.

The most interesting point about this experiment is that it is in accordance with the theory that ammonium would have the properties of a metal if it could be isolated for excepting this substance the metals themselves can only be dissolved in mercury

The second photograph is an illustration of an experiment depending upon the peculiar property of aluminium amalgam

The action of sulphuric and nitric acids upon ordinary aluminium is very slow because the metal receives a coating of aluminium hydroxide and is shielded from the acid, but if the aluminium is amalgamated with mercury, the action is very rapid

Aluminium has a very great affinity for oxygen, and will displace all the metals save magnesium from their oxides If a mixture of aluminium powder and ferric oxide is placed in a crucible, and fired by means of a piece of burning magnesium, a violent reaction takes place enough heat being produced to leave the iron, which is one of the products in a highly molten state This is the principle of the "thermite" used for welding, etc

$$Fe_2O_3 + 2\,Al = Al_2O_3 + 2\,Fe$$

Some idea of the speed of reaction and the heat generated may be gained if three small iron crucibles are placed in a vertical column, one above the other and separated five or six inches A mixture of aluminium and ferric oxide is placed in the top crucible and ignited Almost immediately molten iron will melt its way through the bottom of the first crucible and pass through the second and third as if there was nothing in the way A box of sand should be placed beneath the bottom crucible to catch the molten metal

The affinity of aluminium for oxygen can be shown by amalgamating a piece of the metal with mercury The surface is almost immediately oxidized and the result is a growth of white tufts of aluminium oxide over the surface of the metal where it has been amalgamated The growth will rise about one-eighth of an inch or more in five minutes.

The easiest method of amalgamating the aluminium is to clean a small portion, and then drop upon it some mercuric nitrate solution and allow it to dry The growth will immediately commence

In the illustration, the case of an aluminium backed telephone receiver has been used for the experiment, and the resulting growth is shown by the white spots, principally on top at the left

The third photograph is a striking illustration of osmotic pressure The tall plant like growths may be formed by throwing small pieces of any of the following crystalline chemicals ferric nitrate copper chloride cobalt nitrate, nickel sulphate and manganese sulphate into a beaker glass containing a diluted solution of sodium silicate of 1.1 specific gravity The crystals will almost immediately sprout up into various fantastic shapes, and grow several inches in the course of a few minutes.

The salts dissolve in the water of the sodium sili

cate solution and react with the sodium silicate to form a silicate of the metal of the salt added For instance in the case of copper chloride copper silicate is formed

$$CuCl_2 + Na_2SiO_3 = CuSiO_3 + 2\,NaCl$$

Silicate of copper is insoluble and so the result of the reaction is a small portion of liquid around the crystal of $CuCl_2$ surrounded by a sack of insoluble $CuSiO_3$ where the copper chloride has come into contact with the sodium silicate

Particles of a *dissolved substance* exercise a pressure similar to that of a gas explained in physics texts under the title of the kinetic molecular hypothesis

When the sack is first formed the pressure is equal on both sides but as more of the copper chloride dissolves the pressure on the inside of the sack becomes so great that it bursts at the top where the *hydrostatic* pressure of the liquid is least and the sack weakest

The liquid spurting out of the top is immediately surrounded by a new sack and the process continues until the salt is exhausted or the growth reaches the surface of the liquid

The silicates of the metals of the salts mentioned in the list above are also insoluble and the same explanation holds true for their action

WIRELESS EXPERIMENTS WITH A STATIC MACHINE

BY E M WI IAMS M JR

In the large quantity of literature on wireless telegraphy practically the only method described of producing the high tension currents required is that of using a powerful induction coil or a high tension transformer on an alternating current The possibility of utilizing the discharge from a direct generator of static electricity is barely touched upon In order to test the practicability of the use of such a source of current the writer constructed a static machine of the Wimshurst pattern and made some experiments with it The machine a photograph of which is shown herewith was fitted with two glass plates twenty inches in diameter supported on a half inch steel shaft Each plate had thirty sectors of heavy tinfoil 3½ inches long The brass work was made from 3 16th round rod and the brass balls on the collectors and Leyden jars were purchased from a manufacturer of brass bed steads as were the large balls terminating the discharge rods and the sending device below These balls were filled with crushed tinfoil and contact made by inserting the supporting rods in wooden bushings fitted in the necks of the balls

The two Leyden jars showing at the front of the machine were made from hydrometer glasses provided with feet and each had a combined inner and outer coating of 65 square inches of foil The interior coatings were arranged to be connected with the discharge rods by short loops of brass chain and the exteriors joined with a similar chain laid along the base of the machine The device shown attached to the front support is the key by which the spark is thrown into the aerial and ground and the messages sent By pressing the lower lever the rocking arm above it which supports the two insulated balls is pulled upward and the latter are thrown into range of the spark from the discharge balls One of the key balls is connected to the aerial and the other to a good ground such as a gas or water pipe I found it best to allow the aerial ball to take its charge from the positive discharger By pressing the key for longer or shorter intervals the dots and dashes of the code are easily obtainable

An aerial was erected on my roof at a height of 40 feet above the ground consisting of two horizontal copper wires supported on two-foot spreaders with leads off near the center running to the edge of the roof where they were joined and a single wire led thence to the machine on the third floor This aerial gave a wave length of about 72 meters Owing to the extremely high tension and evanescent nature of the discharge it was necessary to insulate the wires with great care which was done by supporting them in paraffin glass tubes The machine as constructed gave a solid stream of bright two-inch sparks resembling those from an induction coil when the large discharge balls were used and the jars unconnected With the latter in circuit in the usual manner a very thick loud and powerful spark of about the same length was obtained at intervals With a large ball on the right hand rod and a small one on the left, a much thinner and more frequent spark from five to six inches long appeared

The first experiments in sending messages were conducted with the receiver in a room about thirty feet away from the machine, using a gaspipe ground and

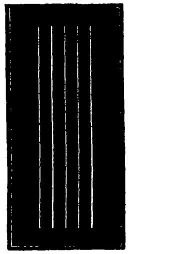


Fig 1 —GRATING WHICH GIVES THE COLOR ILLUSION

no receiving aerial A number of detecters were constructed experimentally including a coherer and decoherer with a ¼ inch gap filled with nickel silver filings a microphone consisting of a piece of hard pencil lead bridging two steel needles a bare point electrolytic and a Marconi magnetic detector In all the tests made the coherer gave the best results at short range and the microphone the best for longer distance indeed the sounds were much clearer in this case than when the electrolytic was used though the latter is considered the most sensitive of all

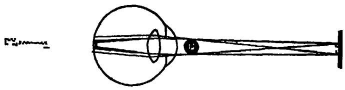


Fig 2 —DIAGRAM EXPLAINING THE COLOR ILLUSION

In these experiments a home made relay of 200 ohms resistance was used with the coherer and a pair of 75-ohm ear phones with the microphone In the experiment conducted in the near by room the straight spark from the discharge balls was used and gave clear signals The coherer was then moved to the back yard and provided with a ten foot aerial stretched horizontally six feet above the ground the other connection being to a water pipe The signals were still received clearly but on increasing the distance to three hundred yards no result was obtained with either receiver although the aerial was extended to a length of thirty feet

In order to increase the power of the spark the inner coatings of the jars were connected to the dischargers the outer coatings still remaining unconnected

By this arrangement a shorter thicker and more brilliant spark was thrown into the key balls which while not as frequent as in the former case was sufficiently continuous to easily permit sending distinct dots and dashes when the machine was driven at a slightly higher speed The microphone now responded clearly when the key was worked showing the increase in efficiency of the new arrangement and a more ambitious experiment was decided upon The receiving station including microphone telephone receiver tuning coil batteries, etc was transferred to a house three-quarters of a mile away and a receiving aerial erected As the owner of the house objected to the use of the roof for this purpose I was compelled to put up a rather inefficient aerial of a vertical type, projecting from a third-story rear window

Three clothes props were spliced together for a support, and a three-foot spreader fixed at the top, from which were suspended a pair of copper wires thirty feet long These wires were joined at the bottom and led to the tuning coil, which had a capacity of 135 meters and thence to the microphone At a prearranged hour my better half patiently worked the static machine at the sending end for fifteen minutes, sending dashes at slow speed and in groups of three, to avoid confusion and these signals could be faintly but unmistakably heard in the phones at my end.

I have no doubt that with a more efficient aerial, variable condenser high resistance head phones, and potentiometer for the battery the receiving distance could be enormously increased Possibly a zinc spark gap and sending helix would be an advantage at the sending end A multiple machine, having three or more pairs of plates would probably have sufficient capacity to rapidly charge and discharge a small pair of Leyden jars and so send greatly increased power into the aerial and increase the radius of efficiency The details of the spark gap showing the character of the spark as given from the interiors of the jars alone as used in the foregoing experiments are shown in one of the photographs The receiving apparatus with the exception of the tuning coil is also shown herewith

A COLOR AND RELIEF ILLUSION

BY PROF GUSTAVE MICHAUD COSTA RICA STATE COLLEGE

Hold a pin vertically with its pointed end between the thumb and forefinger Place the pin thus held before your eye in contact with your eyelid Close the other eye and look at the drawing Fig 1 this being at a distance of about three to five inches from your eye

Two differently colored gratings apparently placed at two different distances from the eye both of them made up of vertical lines will immediately appear One seems to be relatively near Its lines have a dark brownish hue The other is made up of dark bluish bars and every one of these seems to stand at a distance behind the first grating If the figure be moved laterally the near-by brownish lines are seen to move on with the paper but the bluish bars run in the opposite direction

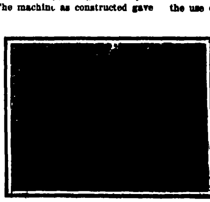
The near-by brownish bars are the black stripes of the figure In spite of the fact that the distance between the figure and the eye is shorter than that of distinct vision the stripes are not much blurred as the pin decreases the aperture of the pupil and thereby increases the depth of focus

The far away bluish bars are the shadows cast by the pin on the retina in the middle of every luminous beam sent by the corresponding white line The shadow is cast right side up but the retina inverts it and the result is the curious inverse motion of the bluish bars when the paper or pin is made to travel laterally

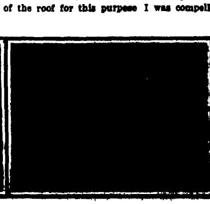
The origin of the bluish color of these bars is shown on Fig 2 $L\ L$ is the cross section of a white line The pin P (relative size is exaggerated) closes the central part of the crystalline lens and as the achromatism of the periphery is imperfect there is a rather strong dispersion of the white light The blue rays $B\ B$ of the shaded spectrum invade the obscure central zone which is the shadow of the pin This assumes a bluish hue For a similar reason the less refrangible colors red and yellow lag behind and remain on the image of the black stripes right and left of the white line The admixture of colored light to the dark stripes is increased by the fact that the whole image being out of focus the limit between the black and white lines cannot be sharp

The blue rays meet to a focus before the red and yellow rays they give therefore the impression of coming from a far-away luminous object The contrary statement is true for the red and yellow rays. This accounts in part for the fact that the brownish bars seem to be nearer than the bluish lines. The writer confesses however that this explanation does not entirely satisfy him

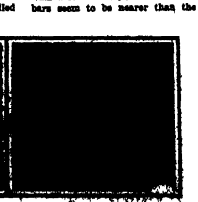
Indestructible black ink is made from 1 part lampblack, 12 parts water glass of syrupy consistency, 1 part liquid ammonia, 1 part of distilled water.



RECEIVING APPARATUS, SHOWING THE MICROPHONE DETECTOR.



PHOTOGRAPH SHOWING CHARACTER OF SPARK DISCHARGE.



THE WIMSHURST MACHINE AND [illegible]

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

SANITARY TELEPHONE-TRANSMITTER.—M. E. Calcott, Seattle, Wash. The mouth-piece in common use is a most prolific source of disease caused by the accumulation of germs therein. This is especially the case with public telephones. The invention provides a device which will take the place of the ordinary mouth-piece and it is covered when not in use, thereby preventing the accumulation of dust or germs. The transmitting members may be cleaned automatically and disinfected each time after use.

Of Interest to Farmers.

COMBINED DISK AND SHOE SEEDING DEVICE.—N. L. Heckman, Marion, Ind. In the present patent the invention has reference to improvements in combined disk and shoe seeding devices, and has for its object to produce a device in which the lower seed conduit or shoe forms a part of the furrow opener and deposits the seed at the periphery of the disk.

WEED-ERADICATING MACHINE.—B. F Scott and J A Scott, Jasper, Minn This machine extracts weeds, roots, rubbish, etc, from the ground, and delivers the above materials into a receptacle by means of a structure which carts it from the field The structure is resilient, thereby avoiding breakage of the machine parts, and the machine is simple and inexpensive in structure

COW STALL.—C S. Torrey, Bellevue, Mich The invention affords a triangular rear wall for a manger, a trench at the rear of the stall for the reception of excrement the rear wall of the manger preventing a stalled animal from stepping too far forward, and there are adjustable means for preventing the animal from stepping backward into the trench while occupying the stall.

APPARATUS FOR MAKING AND PACKAGING BUTTER.—J De Lisle, New York, N Y The object in this case is to provide an apparatus for making and packaging butter aseptically, that is, absolutely free from microbes liable to produce fermentation or putrefaction in the butter or disease in the intestines or other organs of the consumer of the butter

Of General Interest.

EMBALMING INSTRUMENT — T F Riley, Troy, N Y The improvement is in instruments for use in draining the blood from the body in the process of embalming, and the purpose is to provide a device adapted to conform to the curves of the circulating organs, whereby it is possible to reach points ordinarily inaccessible and draw the blood off from two or more places simultaneously

NON-REFILLABLE BOTTLE.—H C. Andersson, Unionport, and F B. Aal, New York, N Y The object of the invention is to provide a durable bottle from which the contents can be easily poured, which cannot be refilled after once being emptied by the ordinary methods, such as by force, submersion, or by the use of a vacuum, and the form of which does not differ radically from that of the ordinary bottle.

PICTURE-FRAME.—E. Oldenbusch, New York, N Y More particularly the invention relates to that type of frame commonly known in the art as a "shadow box." The frame is adapted to hold any form of picture, plaque, photograph, medallion, etching or the like, and is so constructed that the picture is spaced at a considerable distance back of the glass.

NON REFILLABLE BOTTLE.—J Birner, Elizabeth, and E. J Heil, Carteret, N J The aim of the improvement is to produce a bottle having a simple construction which will operate normally to prevent the bottle from being refilled, but which may be manipulated in such a way as to open readily to allow the liquid within the bottle to be poured out

WATER-CURB-BOX LID.—J J Heimbuecher, Pittsburg, Pa. The lid comprises segmented sections hinged together at one edge, with fastening means at an opposite point and provided with depending hook like lugs to underlie a flange on the box the sections combining to form a circular plate adapted to cover a curb box when the lid is lost.

FRAME-JOINT AND METHOD OF SOLDERING THE SAME.—L. B. Prahar, New York, N. Y. This invention relates to improvements in frame joints, and more particularly to a new method of securing together the abutting ends of metal channels going to make up the frame. It may be utilized in joints for bag jaws, picture frames, etc.

NON-REFILLABLE BOTTLE.—A. La Rosa, New York, N. Y When the device is ready for use the operator inverts the bottle in order to discharge the contents, and may remove the cap or not, as desired. The liquid finds its way out around the balls loosely mounted within the valve casing, as it has a clear open passage for this purpose. When, however, the bottle is placed in normal erect position the balls effectively seal the bottle and prevent entrance of any liquid.

Hardware.

HASP-LOCK.—F. McManamin, Jersey City, N. J. This lock may be generally defined as consisting of a staple or other keeper, a hasp adapted to swing into and out of engagement with the keeper at one side of a plane passing through the keeper and the point of pivotal support of the hasp, and a lock to lock the hasp to the keeper, hinged to the hasp to move independently thereof to and from locking position at the opposite side of the plane when the hasp and keeper are engaged.

SQUARE.—T C. Howland, Long Branch, N J The arms of this square may be stamped out or cast from any suitable metal, and when assembled maintain their proper angular relation by providing one of the arms with a longitudinal channel having a branch at or near one end extending through the side edge of the arm, and with the bottom of the channel provided with a slot forming flanges, and the other arm having a portion closely fitting and conforming to the channel and the slot and seated on the flanges.

FAUCET.—H Forsman, Fresno, Cal. An object of the inventor is to provide a device by means of which fluid can be drawn from a tank or other receptacle, and which simultaneously permits the introduction into the receptacle of an amount of fluid corresponding to that withdrawn.

Heating and Lighting.

BOILER TUBE EXPANDER.—J C Tassey, Nashville, Tenn This expander is for use for pressing boiler tubes into boiler sheets. An important feature is the means whereby a cover sleeve fitting over beading rolls may be advanced over said rolls to bear against the flue sheet and permit the projection of the flue beyond the flue sheet during operation of expanding the wedges within the flue after which the cover sleeve may be released and adjusted back over the rolls away from the flue sheet so the rolls may operate on the projecting portion of the flue to bead the same into engagement with the flue sheet

VALVE.—W Shurtleff, Moline, Ill The aim of this inventor is to provide a valve, especially adapted for use with vapor heating apparatus for controlling the supply of vapor to the coils of the radiators, and wherein the size of the opening for admitting the vapor may be contracted or enlarged without the use of special tools.

Household Utilities.

ELEVATOR-CUPBOARD.—C H Weller, Canton, Pa In this instance the invention is an improvement in elevator or disappearing cupboards such as embody an elevator shaft frame in which the cupboard is vertically movable, the shaft frame being erected directly below an opening in the floor of the kitchen or other room where access to the cupboard is to be had.

WINDOW CLOTHES-LINE SUPPORT T A. Macdonald, Clifton, N J Mr Macdonald has devised a support adapted for attachment to window frames by means of a universal joint whereby it is adapted to be swung into different positions as required to enable clothes to be easily placed on or removed from the line, and to be swung into horizontal position when not for use.

SUPPORT FOR SAD-IRONS.—G Ellstrom, Pittsburg, Pa. A hot sad-iron cannot be left standing for an appreciable time upon an ironing board without scorching the fabric upon which it rests. The invention gives a support for the iron while the user is spreading out the article to be ironed. When in non-service position the device is not cumbersome or in the way

TRUCK STRUCTURE FOR GARBAGE OR ASH CANS.—M. T Leon, Salt Lake City, Utah The object of the invention is to provide a structure for garbage or ash cans which will enable the latter to be conveniently handled and transported from one place to another, as from a house to the alley, with little effort In this structure the wheels are securely fastened to the body by simple means.

CHERRY PITTER.—F E. Greene, Courtland, Cal The object here is to provide a pitter that will remove the pits from cherries without mutilating the cherries. Another object is to provide a pitter which will remove the pits without punching holes through the cherries, thus saving considerable fruit.

Machines and Mechanical Devices.

ADVERTISING APPARATUS.—A Weissmann, Berlin, Germany In this device an endless sheet bearing the advertisement is employed It travels over rollers, the driving gear of which includes a clutch coupling and there are illuminating elements which are controlled by the actuating devices of the clutch coupling, for periodically lighting the advertising device

PAPER-FEED FOR TYPE WRITERS.—E. S Mansfield, Atlanta, Ga This improvement relates to a paper-feeding device for typewriters and the object is to provide a device of this class which can be readily attached to a typewriter of ordinary construction, and which will operate to hold a number of sheets of typewriter paper and advance the same in succession to the platen.

VALVE.—W. N Long, Eugene, Ore. This valve is for use in flushing tanks. The valve has a cup movable in relation to an inlet pipe, this cup being provided with a hood for preventing excessive splashing of the water when the cup is raised for the purpose of allowing water, under considerable pressure, to refill the tank.

MECHANICAL STOKER.—T. V. Elliott, New York, N. Y. This stoker is arranged to crush or reduce coal to a fine mesh, to distribute the reduced coal uniformly over the grate surface in the fire box, to insure proper burning of the fuel and complete combustion thereof, to agitate the grate constantly at slow motion with a view to keep the fire clean from dead ashes and prevent coking, and to automatically remove the ashes from the furnaces.

GEARING.—H M Baker, Jr., New York, N Y The invention refers to speed-controlled signaling mechanism, the more particular purpose being to provide a device in which a predetermined speed in a revoluble member forces into or out of action a visual signal so that a person may, by glancing at the signal, tell whether the speed is above or below a predetermined critical point

AUTOMATIC SAFETY ELEVATOR DOOR OPENER AND CLOSER.—F F Boyd, Philadelphia, Pa. The main object of this improvement is to provide a device which will be operated by the elevator itself to open the door when the elevator stops at the adjacent floor and to close it immediately when the elevator is moved up or down

WATER-MOTOR.—W J White, Oyster Bay, N Y The motor is adapted to utilize a small current of water having sufficient head so that a considerable power can be derived The invention contemplates an arrangement of tanks or reservoirs in which the water level rises and falls continuously Automatic means are provided for operating valves which control the flow through the reservoirs or tanks so that the motor operates continuously to develop energy

COMBINATION LOCKING MECHANISM.—H Van Hovenberg, Lake Placid, N Y The invention refers to certain improvements in locks for boxes or other containers, and more particularly to that form of lock in which the two sections or parts, for instance the box and cover, are rotatable in respect to each other, to operate the lock.

ORE GRINDING MACHINE.—J C Tatman, Denver, Colo The object of the invention is to provide a machine arranged to provide a revolving velocity of the grinding wheels or mullers sufficiently high to take up and throw the wet ore particles at a tangent against the enveloping screen and to render the machine non sliming

REVERSING MEANS FOR SHAFTS.—H F Snyder, Perry Township Pa The invention pertains to certain improvements in reversing mechanism, and more particularly to means whereby the momentum of the engine while slowing down stores up energy to start the engine in the reverse direction as soon as it comes to a full stop

PAPER SLITTER.—S M Langston Camden, N J The machine is designed for cutting or slitting a strip of paper into a plurality of narrower strips and rewinding the narrower strips side by side upon a suitable reel A special feature resides in the rewinding mechanism and the means employed for maintaining uniform surface friction upon the rewound strips during the entire rewinding operation

SOUND BOX.—W A Chapman, Smithville, Ark An object here is to provide a box for reproducing or recording the sounds by means of records, employed in phonographs, talking machines, etc, by means of which the sounds can be reproduced with clearness and distinctness, and with all their original tonal qualities, and in which the relatively movable parts are not subjected to excessive wear

TYPE WRITING MACHINE.—H G McCool, Carmichaels, Pa. This inventor received former Letters Patent of the U S for a syllabic keyboard for typewriters and type-setting machines, in which the keyboard has 192 keys, the same being arranged in twelve horizontal rows of sixteen keys each, and each key bearing three symbols to wit a single letter and two syllables of two and three letters respectively By its use great speed is attained The present invention is provided with such keyboard, or practically the same

WIND-MOTOR.—R F E Okranna, Antigua, Guatemala The intention of this inventor is to provide a wind motor, arranged to utilize the power of the wind to the fullest advantage to hold the wind wheel accurately in the wind, to protect the wind wheel in case of storms and to properly transmit the power of the motor to other machinery

MECHANICAL MOVEMENT.—W S Allan Monterey Mexico. The invention has reference to a suitable motion for the operation of a pump having two plungers working in one cylinder one above the other and is especially designed to be operated by a windmill or to be used as a pumping jack in connection with other power

SAFETY DEVICE FOR ELEVATORS.—Z. T Danby, Topeka, Kan This device is particularly useful in connection with elevators operated by means of hoisting cables By means of the device an elevator can be instantly brought to a full stop in case the hoisting cables or mechanism gives way, and which is directly controlled by the hoisting cables.

Prime Movers and Their Accessories.

DOUBLE-ACTING INTERNAL-COMBUSTION ENGINE.—H. O Hoehm and J. F Boyland, New York, N. Y In the present patent the invention is an improvement in double-acting internal combustion engines and belongs to that class of engines in which the driving-shaft is operably connected with the piston through slots in opposite sides of the cylinder

STUFFING-BOX GLAND.—F Kessler, White Plains, N Y The invention has in view a gland in which the sections interlock with each other and are held against relative movement in any direction the bolts or studs for forcing the gland into the stuffing box also serving to force the inner end portions of the sections of the gland together

Railways and Their Accessories.

MAIL-CATCHER.—A M Bridgewater, Denver, Colo The invention pertains to apparatus adapted to deliver and receive from railway trains mail bags and the like It is a device in which the delivery means, both on the train and on the ground is in the nature of a crane, and the receiving means is in the nature of a combined guide and receptacle

TRACK SANDER.—D Tauriello, Newport R I In the present patent the object of the inventor is the provision of a cheaply constructed and simple track sander for use with passenger cars so arranged as to be conveniently operated and easily filled with sand, and which may be applied to existing cars with but little cost.

SLIDING DOOR FASTENER.—F J S. Misly, Gunnison, Colo The fastener is designed more especially for box car doors which are mounted to slide and to swing outwardly at the bottom on the door hangers The invention consists of door brackets door jamb keepers, a cross-shaft having eccentrics journaled in the brackets, and a hand lever to revolve the shaft into and out of locking engagement with the keepers

STATION INDICATOR F L. Pitts, Yuma, Ariz. This invention relates to means for indicating the stopping places along railways, street car lines and the like and the object is to provide a device which may be located in some conspicuous position which may be operated by the brakeman or other employee so as to indicate the next point at which the train will stop

SCREENING APPARATUS.—J H Lynch, Haverstraw, N Y The invention refers more particularly to an apparatus designed for use in screening sand gravel coal or the like into two different grades and delivering each to a separate car or receiver It is designed to be so mounted that cars may be run along separate tracks beneath the apparatus and as soon as filled replaced by empty cars upon the same tracks.

Pertaining to Recreation.

BILLIARD CUE TIP AND FASTENER.—C Marx New York N Y In this instance the object of the invention is to provide a new and improved billiard cue tip and fastener for use on cues with or without ferrules and arranged to securely hold the tip in position and to allow convenient replacing of a worn out tip

GAME APPARATUS.—H O Schreiber and C A Geisz, East Liverpool Ohio. This invention is an improved toy being in the nature of a miniature or table basket ball game The board may be constructed oblong for two players or square hexagonal or octagonal for four, six or eight players. The game may be played for goals and rules may be adopted to suit the players and copied from the basket ball rule book

PISTOL.—M J Shimer Bethlehem Pa The invention provides a cap roll support at a point on the toy pistol such that the roll will be immediately accessible to and at all times within view of the operator and further to so blanket the firing anvil when it is struck by the hammer that the possibility of flying fragments of the cap is eliminated

Pertaining to Vehicles.

EMERGENCY WHEEL-RIM.—W F Jenkins and R L Jenkins Richmond Va The invention relates to attachments for wheels using pneumatic tires, and is particularly applicable to the wheels of automobiles and similar motor vehicles An object is to provide an auxiliary rim which can be attached to the rim of the wheel and which relieves the injured tire from the weight of the vehicle An attaching means is provided so that the working parts are kept from rattling when not in use

Designs.

DESIGN FOR A PLATE OR SIMILAR ARTICLE.—C Ziegler Limoges France In this design for a plate or similar article the plate rim is octagonal in form the various separated angles in which it is laid out being in two alternating lengths A scroll work ornamental border runs around the edge of the article

DESIGN FOR A QUILL HOLDER FOR LADIES' HATS.—H W Schwarz New York N Y.—This design shows an ornamental quill holder The article is flanged at the top and narrows almost to a point at the bottom the whole taking a semi-circular form with two different patterns for graceful ornamental effect

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 18th or will be sent by mail on request.

(12163) J. V. S. says: Kindly help us in an argument. We agree upon the fact that the upper part of a wheel travels faster than the lower part when the wheel is pushed along a road. Kindly state if the same conditions do not prevail when the wheel is driven from the center, as is the case with the rear wheel of an automobile. A. The motion of a wheel is exactly the same whether driven in one way or another, from the center or dragged by a horse. It simply turns around the axle. The angular velocity of every part is the same as measured from the center line of the axle. Since the part of the wheel in contact with the road is at rest on the earth or rail, the top of the wheel is moving twice as fast as the hub, as referred to the point of contact with the earth. We have fully discussed this in Answers to Queries, Vol. 92, Nos. 16, 20, in the Correspondence Column of Vol. 92, No. 25, and in Vol. 96, No. 6, price 10 cents each.

(12164) J. T. S. says: Will you kindly tell me how I can improve the acoustics of my recitation room? It is 67 feet long, 30 feet wide, and the ceiling is 18 feet high. There is nothing in the room but the recitation tables, a blackboard, and fifteen electric light drops hanging from the ceiling. The room echoes so, it is almost impossible to carry on a recitation, or hear anyone speak. A. Your case is a difficult one, the room is as badly proportioned as it can possibly be. It would be much better if it were divided into two rooms by a partition across the middle of its longer dimension. It is more than twice as long as it is broad, a tunnel in fact. The usual remedy for echoes is to hang soft curtains or other drapery upon the walls to interfere with the reflection of the sound waves. This would doubtless cure your room, but the cure is expensive.

(12165) J. H. B. says: 1. What is the highest resistance that an ordinary dry cell can overcome? How much current will an electromagnet wound to four ohms resistance use? Also, will one wound to twenty ohms use more or less current? A. The current which a dry cell can send depends upon the resistance of the circuit in which it is placed. The voltage of a dry cell should be about 1.4 volts. Against a resistance of 4 ohms this cell can send about 3 amperes, found by dividing 4 by 1.4. This is in accordance with Ohm's law. If the resistance is higher, the current is less. If there are 20 ohms, the current will be only a fifth as much as with 4 ohms. A dry cell can send a current which can be detected by a delicate instrument even when the resistance is many hundred ohms. That depends on the sensitiveness of the instrument. 2. What size wire and how much will be required to wind a magnet of four ohms resistance? A. The size of wire for an electromagnet must be selected for the current which is to be used in the magnet. If you use No. 24 wire you can take 40 feet to the ohm. 3. What is the best way to make and charge a permanent magnet? A. To make a permanent magnet get a piece of good steel—tool steel is ordinarily used—and harden the ends glass hard. Then draw the bar across and off from the pole of a strong magnet. It will be magnetized so that the end of the bar which leaves the magnet last will be a pole opposite to that of the magnet. The bar should be drawn across the magnet pole 15 to 20 times.

(12166) J. H. C. says: Steel resists the power of magnetism more than soft iron and heat destroys the magnetism of a steel magnet. Now suppose you heat a piece of magnet steel and temper it properly while in a powerful magnetic field, will the point of magnetic saturation be raised or lowered, or will it be the same as if magnetized at ordinary temperatures? A. If steel is heated till its magnetism is destroyed, and then tempered in a strong magnetic field, its magnetism will be restored, and if the field is strong enough, the bar will be saturated. The degree of magnetism which constitutes saturation will not be affected by such treatment. Saturation depends upon the kind of steel and the magnetic force to which it is subjected.

(12167) H. A. B. says: 1. Would you kindly tell me how large a spark would a Wimshurst influence machine give which has 16-inch plates, each having 16 segments on them of tinfoil? A. A static machine, Wimshurst or Holtz, may give a spark as long as the distance between the sectors at their nearest points across the axle. Without Leyden jars the spark is a thin blue line. With the jars the spark is shorter, but far more intense. It is the spark due to the heavy discharge of the jars. 2. Could I increase the length of the spark by Leyden jars or by adding more segments to the plates? A. You have the proper number of segments upon your plates at present. You will find in our Supplement Nos. 278, 279, 283, valuable articles upon the Holtz machine, with many experiments; and in Supplement Nos. 548, 584, 647, 914, 942, 1151, valuable articles upon the Wimshurst machine. We will send the papers for ten cents each.

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending December 28, 1909,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

MECHANICAL BOWLING MACHINE.

(Concluded from page 24.)

trifugal force affected by the band, causes the ball to swerve during its flight. In this operation, though the hand is revolved, the drum upon which the ball rests in the palm or cup is stationary. This device is brought into action when it is desired to give the ball a "spin." There is a groove in the drum in the palm over which a band is passed, and which by suitable arrangements is carried to the same points as the "swerve" pulleys. For imparting a pure spin to the ball, the pulley rotating the hand as above described is thrown out of action, and simply the drum in the palm upon which the ball rests revolves during the travel of the arm on an axis parallel with the drum and at right angles to the line of flight instead of revolving on an axis parallel with the line of flight, as in the action to produce swerve. If desired, both actions can be brought into use at the same time, and then the ball is given a compound or refractory gyration—a combination of swerve and spin—which delivery puzzles the most accomplished batsman because of the erratic and constantly varying rotary axis of the ball.

The device is aptly suited for practising purposes. The velocity of the ball can be altered at will, and there is a "velocemeter" mounted on the machine to indicate the exact momentum during flight. The variations possible are very extensive, and no two successive balls need be delivered alike, the change being effected without the batsman being aware of the fact, or if desired a certain type of delivery can be repeated *ad lib* Every gyration can be adjusted as desired, and indeed it is possible to mechanically reproduce the deliveries of any particular bowler The "break," i. e., the tangent to right or left produced when the ball strikes the ground, is measured by a graduated sight, which also indicates the swerve of the ball to one side or the other during flight Similarly, the ball can be made to leave the "hand" at any point of the arm's travel, there being a series of stops to secure this end In this manner the pitch of the ball, that is the distance from the machine to the point where it comes into contact with the ground, can be easily varied, and similarly the ball can be made to strike the ground in such a way that after the impact it shoots forward at great speed

The machine is mounted on telescopic legs, and the height of the delivery of the ball can be made to coincide with that of any bowler whom it is desired possibly to imitate, the variable range being from six to eight feet above the ground. The mechanism is also arranged to swivel on its body, so that the bowling arm can be pointed in any direction without moving the body The arm is brought to the horizontal position by means of a lever, by which it is also trained and released, and at the same time a disk is raised to warn the batsman of the impending delivery Every ball delivered is moreover registered automatically upon a dial.

AUTOMATIC RAILWAY SAFETY STOP.

(Continued from page 25)

duced the locking wedge into its normal position.

The remarkable safety of this apparatus is mainly based on the considerations (1) The locomotive personnel is warned in a triple manner on a closed signal being passed over, viz., (1) by a siren (2) by a warning disk, and (3) by the brake being actuated. (2) The train is stopped: (1) By ordinary braking (in the case of preliminary signals), (2) by high-speed braking (in the case of main signals with two pairs of contacts). (3) The question as to whether the locomotive personnel line men or station personnel, are guilty, will be fully indicated by the dash and dial records. (4) The track contacts which are only 2.5 kilogrammes in weight, are extremely easy to transport and are readily installed

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Lights, adjustable hanger for, H J Hinde 944,790

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(Concluded from page 31.)

any fish-plate in order efficiently to protect any trains stopped on the track, etc. (5) The fact of the apparatus being disabled by breakage of the lever is automatically signaled to the engine driver by the disk bearing the inscription "apparatus out of working." Moreover, a specially ingenious construction enables the apparatus even then to work as usual on passing over the next signal.

The working condition of the apparatus can be ascertained at any time simply by throwing the lever back and then disengaging the apparatus. The safety stop above described is constructed by the Gesellschaft für Zugsicherung und Patente der Stahl- und Eisenindustrie, of Berlin.

GRAPHITE MINING IN CEYLON.

(Continued from page 29.)

not be determined without further examination. Much smaller quantities of graphite occur as flakes in many of the granulites and in the crystalline limestones, when it invariably forms small tabular six-sided crystals with well-developed basal cleavage. In these cases, according to Dr. A. K. Coomaraswamy, the director of the Mineralogical Survey, the graphite behaves like the other accessory minerals, and there is no reason to suppose that it has been subsequently introduced.

Evidently the graphite in the veins has been deposited at a time posterior to the consolidation of the granulites, and they are of the most typical character. Usually they consist of pure graphite with occasional evidences of more than one period of deposition in a zoned structure of the vein. Metamorphism of the surrounding rocks near the veins is found on only a small scale, the rock surfaces in immediate contact with graphite being impregnated with the carbon no more than about half an inch. Neither are the quartz and other minerals associated with the graphite vein filled with disseminated graphite, the latter occurring only in strings filling cavities or cracks in the quartz. It is evident that the deposition of the graphite must have been from vapors or liquids saturated with mineral (carboniferous) matter.

The best producing districts are Kegalla, Ruanwella, and Pasdum, but areas are found over the island with the exception of the northern and eastern portions. The mining is almost exclusively in the hands of the natives, and primitive methods obtain. There are but little organized means of prospecting. A villager stumbling across evidences of graphite immediately completes arrangements for working it. A pit is sunk until the vein or deposit is gained, and the mineral extracted until the yield fails. When walking through plumbago areas, numerous abandoned shallow pits may be seen alongside the roads.

In the richer districts more methodical working is adopted, but even here there is a quaint antiquity about the mining equipment. The pit rather resembles a fissure in the rocks than a symmetrical excavated shaft. At the top a heavy staging or platform is erected, from which extends downward to the working levels a crude ladder fashioned from lengths of bamboo secured together to form a continuous run with coir or native made jungle rope. The transverse sections forming the steps are likewise made from pieces of bamboo similarly secured to the side members and spaced somewhat widely apart.

In many instances the ladder comprises sticks of bamboo extending across the width of the fissure and imbedded in the earth on either side ranged at a slight angle, so as to give the impression of an inclined flight of steps. The bamboo sticks are rough, and being spaced widely apart are somewhat difficult to negotiate to [illegible] but the little [illegible] the countless journeys [illegible] tives with their [illegible]

(Continued from page 36)

(Continued on page [illegible])

(Continued from page 36)

with the mineral which under the friction of the bare feet has a most brilliant polish and is dangerously slippery except to the active movements of the miner

The graphite is excavated by equally crude tools and instead of being hoisted to the pit mouth by rope and pulley is loaded into tall baskets of native manufacture resembling small barrels loaded on the shoulders of the native who carries it bodily up the long ladder to the pit mouth As a result in a busy pit there is a constant endless train of ascending and descending natives bearing their baskets swarming up and down like flies their bodies covered with plumbago brightly polished giving them the appearance in the sunlight of moving figures wrought in bright steel

Should the pit become flooded a simple system is adopted A rude conduit formed of lengths of wood placed diagonally together so as to afford a V channel is improvised which leads to a lower level a small orifice being bored through the side of the pit if necessary to secure the outlet The water is baled out by natives equipped with small vessels

At one or two of the pits where the veins are abnormally thick some pretense to modern mining methods is made The water is removed by the aid of steam pumps and the native artilers are displaced by power hoisting plants hauling the mineral from a depth of four or five hundred feet to the surface At Pelawatta the most extensive workings in the Pasdun korale such an installation has been laid down and here the prevailing conditions warrant the outlay for such machinery since one main vein striking north and south has a maximum thickness of twelve inches

Owing to the heavy demand for graphite that ensued as a result of the South African war when $31 per ton was realized a plumbago fever broke out among the natives Such a price induced individual working and illicit mining on crown lands Even to-day the latter traffic takes place Should the mineral be proved to exist on the government property licenses are daily issued by the authorities to respectable individuals to exploit the deposits but the natives resort to poaching

The graphite as it is mined is taken to the cleaning and grading works It is first submitted to a preliminary hand selection all the large pieces which are for the most part pure graphite or are associated with pyrites and selenite being placed on one side The sieves comprise screens of varying mesh stretched on wooden frames inclined at an angle over which the mineral is emptied from small shallow baskets and then rubbed by hand the larger or coarser pieces falling to the base of the screen while the minute particles pass through the meshes This process is repeated several times work being commenced first on the smallest meshed screens In this manner the dust and much of the friable loose earth is separated This phase of the work is carried out by women and children

Sifting completed the graphite then undergoes cleaning The product being brought in from various localities may be found associated with other matter such as ironstone or carbonaceous deposits of various descriptions and this deleterious material is removed by hand This operation also serves to separate the mineral into two qualities the market price of which averages from $175 to $200 per ton for the first and from $ 0 to $125 per ton for the second grade

The industry has attained great prosperity upward of 30 000 natives being employed in the mining of the article the value of which production considerably exceeds $5 000 000 per annum The industry is also for the greater part in the hands of the natives many of whom have amassed considerable fortunes since owing to the cheapness of the labor, ample supplies of which are readily avail-

(Concluded on page 39)

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(Concluded from page 37.)

able, while the capital outlay is s..all, a handsome profit is secured The industry is however somewhat controlled by the government, which levies an export duty of about $2 per ton, representing an annual contribution to the revenues of the island of about $100,000 The increasing extension of crucibles in the metallurgical industries, and the resultant increased demand for graphite is responsible for the present flourishing condition of the industry

Woven Aluminium.

Aluminium, as is well known is extracted from clay and it was Napoleon who styled it the "silver of clay" Formerly it was the practice to extract it from the clay with the aid of retorts More recently the electrical current is employed for this purpose with marked success, the cost of producing this valuable and by no means fully utilized metal, having by its employment been very much reduced In 1860 a pound of aluminium cost about $40 nowadays it costs only about 20 cents Above all other metals, aluminium has the greatest specific lightness with the greatest durability and toughness It can be rolled, cut and drawn exceedingly fine This has made aluminium valuable and useful in the textile industries For many years, woven sieves or screens have been made of aluminium, which have proved indispensable in the sugar refining industry Its principal advantage consists in the fact that the surface of the aluminium, on the slightest exposure to the air becomes covered with a coating of oxide which is capable of offering almost perfect resistance to foreign influences such as acids, etc This is likewise of great importance where aluminium is used in the textile industries

Speaking of actual weaving of aluminium into special fabrics, particularly such as are intended for use for decorative purposes and costumes, it may be stated that this is well and successfully practised in England At the time of the Paris exhibition, there were shown as special attractions fabrics and clothes made from glass fibers They were made from finely spun glass with silk The fabrics made from aluminium do not need combination with other textile yarns Of late the most beautiful effects have been obtained by employing aluminium in smooth as well as twisted threads for the warp and as the weft silk yarn of any desired color They are used for evening cloaks and theatrical costumes As the Textil Woche says it makes the body of a beautiful woman look as though dipped in silver From aluminium, they are now making neck cloths pompadours shoes belts neck ties shawls and hats, and it is hard to prescribe a limit for the possibilities of this metal Very striking are net fabrics in combination with aluminium which constitutes a select novelty for interior decoration Aluminium yarn made up into laces for ladies' shoes as well as used for straps, promises to be a feature of the coming season

It would be quite an advantage to the motorist, states a contemporary, if he could communicate by wireless telephone with his garage or the nearest repair shop in case of accident An American inventor who is developing a system of wireless telephony recently made experiments with portable apparatus to determine the range of service of the instrument. He was able to communicate over a short distance with a garage in Newark, but at a distance of eight miles the apparatus failed Apparently wireless telephony will have to be developed far beyond its present efficiency before it can be of service to the motorist The chief difficulty is that only a short transmitting antenna can be used, requiring an enormous expenditure of energy to reach a city garage, because of obstacles in the way, such as steel buildings, trees, wires, etc.

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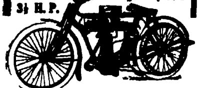

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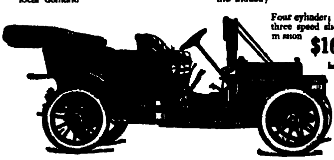

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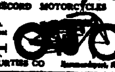

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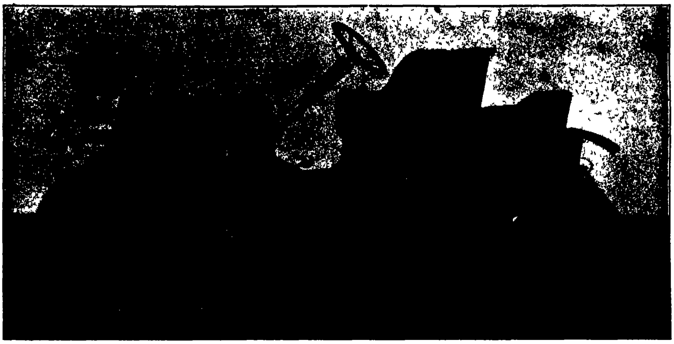

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Think of it—$485 for the best-built, most thoroughly proven, easiest riding, most economical, handiest small automobile in the world!

The New Brush Runabout not only outclasses all small cars but is far ahead of its own previous high standard

Even though we have learned the lessons all manufacturers have to learn by experience—even though we have manufacturing facilities as nearly perfect as money and brains can make them—still we could not build a car of the quality of the 1910 Brush if we merely imitated the big cars with all their complicated parts and all parts necessarily smaller and weaker

Here's where the genius of the designer counts

The Brush has always been and still is the only real Runabout built in America

The new 1910 Brush is not a designer's dream but the result of years of experience and a knowledge acquired by manufacturing 3,000 Brushes that are in daily use It is a car which with one chassis adapts itself perfectly by change of bodies to a hundred different uses

It is a car new in power, smoothness, speed and looks but built on proven principles by an organization already perfected

The Brush has the fewest possible parts but they are of sufficient size and strength to stand the hardest knocks

Simplicity makes it possible to build the car right and still sell it at this wonderful price

As for reliability there is no comparison between the Brush and any of the small imitations of large multi-cylinder cars

With the new Brush you get single-cylinder simplicity, reliability, light weight low gasoline and oil consumption, low tire expense with four-cylinder power and smoothness

Its new balanced motor runs as quietly as a four-cylinder and is as flexible Its power is astonishing

The most wonderful improvement in Motor Car construction in years

While the balanced motor is the most remarkable feature of the 1910 Brush, we have made numerous other improvements and refinements

Here are some of them wheel-base lengthened 6 inches more graceful and rakish lines Mercedes type radiator new selective control universal coupling-shaft, improved dust-proof commutator multiple disc low and reverse clutches, transmission control levers entirely housed and oil-tight more quiet muffler

In our magnificent new plant we make every part of the Brush except the wheels tires and electric equipment The Brush buyer pays no middleman's or parts maker's profit

READ THE SPECIFICATIONS

Motor—10 H. P., *balanced* single cylinder, four cycle, vertical, 4" x 5" water cooled; located in front under hood; every part instantly accessible; three point suspension.

Balancing—After balancing by the usual counter-weights, one extra loaded balance gear, driven by a crankshaft gear, is applied, the result of which is to take out *all* of the vibration due to reciprocating weight and in addition *most* (or at times *all*) of the torque vibration—*theoretically in better balance than a four-cylinder motor.*

Transmission—Internal gear type, perfectly quiet; entirely enclosed and absolutely oil-tight.

Cooling—Mercedes type radiator on Briscoe thermo syphon system, eliminating pump.

Drive—Double side chains to rear wheels.

Control—Single hand-lever of selective action for all speeds spark and throttle under steering wheel; foot pedal releases clutch without touching the hand-lever and also applies the brake This clutch release by the foot is one of the fine features of the Brush and is found on no other low priced car

Steering Gear—Another exceptional feature; internal reducing spur gear slow and powerful at straight ahead and accelerating as the wheel turns entirely enclosed and oil tight

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Tread—56" For Southern trade 60"

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Color Maroon except coupe

Body Divided seat, trimmed in high grade leather Platform on rear as pictured above with equipment $485 00

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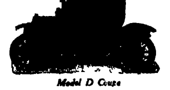
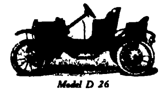


Model D Coupe



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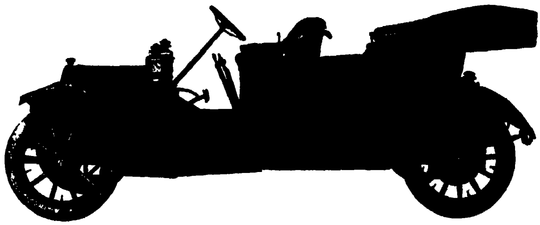

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We venture the prediction that the principal changes which will be made by progressive American manufacturers during the next year or two will be the adoption of the features which are found *now* in the White gasoline car.

The price of the White gasoline car ranges from $2,000 for the Model "G-A" touring car to $3,800 for the Model "G-B" landaulet.

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THE MACHINE-HORSE OF THE MODERN FARMER.—[See page 50.]

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NEW YORK, SATURDAY, JANUARY 15th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE 1910 AUTOMOBILE

CONVINCING evidence that the automobile of to-day is as far perfected as the materials of construction and mechanical ingenuity will allow, is afforded by the fact that the cars shown in the two annual exhibitions this year exhibit no novelties of a radical character as compared with the cars of the preceding year. Indeed, were it not for the relatively short life and high cost of the tires, the automobile would surely be entitled to rank as the most perfect and economical means of transportation of the present day. As to whether some cheaper and more durable substitute, having the same resiliency as rubber, will be found during the immediate future, we can only say that there is not at present, as far as we know, any promise that such a substance will be produced. At the same time, the development of the car has been along lines that are highly favorable to the life of the tire, for both the weight and the horse-power have been greatly reduced. Moreover, the average owner is beginning to understand that the exercise of discretion in the use of the brake, in avoiding rough places on the road and in slowing down at curves, will add from fifty to one hundred per cent to the life of the tires.

The tendency toward standardization is even more marked this year than last, and the freak car is conspicuous by its absence. The predominance of the four-cylinder motor would indicate that this is to be the prevailing type of the future. The six-cylinder motor is being made, but in spite of its acknowledged advantages of more even torque, etc., it is mainly confined to expensive cars of high power. An encouraging feature, based upon thoroughly sound mechanics, is the increased length of stroke, two of the leading makers exhibiting 30-horse-power cars with cylinders $3\frac{1}{2}$ inches by 5 inches stroke and $3\frac{1}{4}$ inches by 5 inches stroke respectively.

Undoubtedly, the present flood tide of prosperity in the automobile industry is due largely to the fact that a multitude of people of moderate means, who have been waiting until a thoroughly serviceable car embodying the latest improvements was placed on the market at a low price, is now being accommodated. Several makers are offering a four-cylinder 20-horse-power car having all the features of stylish design, accessibility to the parts, and ease and certainty of control, of the more costly designs for the low price of $750. Cars of this type have proved during the past year that with judicious handling they are perfectly well able to stand up under constant and severe service. For all cars the four-cylinder, four-cycle engine, with variations in the valve arrangements to suit the tastes of the various builders, has become the standard type, and the indications are that ultimately the cylinders will be cast *en bloc*. Crankshaft ball bearings have given place to babbitt parallel bearings of liberal area, although a few first-class makers are using a modified ball bearing with an outer rotating ring. For axles, although a few still use the balls, the roller bearing seems to be established as the standard practice.

There is a practically universal use of high-tension ignition. All machines down to the lowest priced, use magnetos with either a four-cylinder coil and timer as auxiliary or a dual system of ignition. The shaft drive is in almost exclusive use, the chain being retained only on very large cars. The transmission, except on the smallest cars, is almost invariably of the sliding and selective type, with three speeds ahead and one reverse, and the excellent results obtained by those firms which have placed the transmission on the rear axle are bringing this arrangement into general favor.

Lubrication is effected mainly by two systems, one employing "splash" lubrication, in which the cranks pass through a bath of oil contained in the bottom of the crank case, and the other employing a trough and a pump, which causes a constant and positive circulation through every bearing. Outside of a tendency to enlarge the size, there are no notable changes in the valve mechanism of American cars, and it is rather remarkable that, in spite of the increased use which is being made abroad of the slide valve (a distinctly American invention), there seems to be no disposition to develop this type in the land of its birth.

Although the multiple-disk clutch bids fair to become the exclusive type abroad, the familiar, leather-covered cone clutch has rendered such excellent service on American machines that it still holds its own, and this in spite of the fact that the multiple-disk type has been giving good results on such American cars as carry them.

In the manufacture of car bodies, there is a marked tendency toward the adoption of straight line designs. Several stylish-looking cars, both of medium and high power, are shown with the much-talked-of torpedo body, in which both the front and rear seats are entirely inclosed, the cars being provided with side doors, forward as well as behind. The provision of doors that open toward the front instead of toward the rear is commendable, both from the standpoint of convenience and safety. An additional advantage of the torpedo body is that it provides excellent protection against the rush of air, particularly on high-speed cars. A notable tendency of the times is the growing popularity of wind shields and "tops," the appreciation of the former being due largely to the general objection to wearing goggles. The use of tops renders the motorist comparatively independent of the weather, and they unquestionably add to the all-round comfort of touring.

The question of the relative advantages of the right-hand and left hand drive is coming to the front, and some makers are offering cars with steering wheel placed at the left of the car. Unquestionably the right hand position is preferable in those foreign countries where the rule of the road in meeting and passing is the opposite of our own. There, in meeting a car one passes to the left, and the driver, if seated on the right of the car, is in a favorable position for judging of the necessary clearance. In this country, where the rule of the road is reversed, it would seem logical also to reverse also the position of the driver.

The handsome display of motor trucks forms perhaps the most notable feature of this year's exhibition, no less than seventeen different makes of commercial motor vehicles being shown at the Grand Central Palace. In quality of design and workmanship, and in the variety of uses for which the vehicles have been built, this section compared favorably with the best work shown in the other automobile exhibits, and as one passed from one to another of those powerful machines and noted the excellent combination of compactness and great capacity the impression became strong that at length after many years of discouragement, the motor vehicle had come into its own. Certainly the statistics of the trade bear out this conviction, for it is estimated that during the coming year about fifty thousand commercial vehicles will be built in this country alone. This gratifying result is the outcome of several years of careful experimental work, in which wholesale houses, department stores, express companies, and the big brewing concerns have been trying out various designs of vehicles under widely different conditions of traffic, both in summer and winter. That the manufacturers themselves have faith in the future of the industry is proved by the fact that, in several cases, they are considerably enlarging their plants to meet an expected increase in the demand, and one firm alone in the West, is to-day in a position to turn out five thousand motor vehicles for commercial use during the present year.

IMPROVED QUALITY VERSUS PRICE REDUCTION

FIVE years ago or more, when a man paid $3,000 or $2,500 for a touring car, or $650 to $1,200 for a runabout, he scarcely expected to get much in the way of reliability and durability—or, if he did, in the exuberance of unsophisticated anticipation, he was pretty sure to be disappointed before he had used the car many days. The narrative of an automobile run in those days was usually a recital of a series of troubles of various sorts, chiefly with tires, carbureter, and ignition, but also frequently with breakages and imperfect functioning of valve mechanism, shafts, gears, chains, and even steering knuckles, driving axles, and other vital parts.

Conditions are very different in the present state of automobile development, when it becomes a matter of surprise to even well-posted observers that eight out of thirty cars taking part in the Glidden tour of 1909 should finish an arduous trip of 2,640 miles run between Detroit, Chicago, Minneapolis, St. Louis, Denver, and Kansas City in fifteen days at an average speed of twenty miles an hour during the daylight running periods, without suffering a single involuntary stop for repairs, or for adjustments of any sort on the way except to brakes, carbureter, the ignition system, and tires. Considering the road and weather conditions under which the work was done and the lack of daily inspection, cleaning, and adjusting, this probably represents a higher degree of efficiency and performance than can be shown for any other mechanical construction.

The wonderful improvement in motor-car quality made evident by the results of this test and by a comparison of the specifications of the machines of to-day with those of machines selling at about the same prices in the early part of the decade now drawing to a close, is due to a number of contributing causes, but to none more than to the production and use of special grades of steel, bronze, aluminium, and babbitt having certain definite physical properties suited particularly to the requirements in different parts of the automobile. The manufacture of first-class or even reasonably satisfactory motor cars in this country was practically impossible until the then small group of experimenters and builders were able to convince the metal manufacturers of the large possibilities of the automobile industry, and thereby induce them to undertake the production of nickel steel and chrome nickel steel for use in crankshafts, transmission shafts, driving axles, sliding, differential, and steering gears, steering knuckles, and similar parts, and of manganese bronze, phosphor bronze, and various aluminium alloys for use in crankcases, gear boxes, steering-gear housings and similar parts demanding great stiffness combined with light weight. The automobile industry is very largely responsible for the discovery of the physical properties of chrome-nickel steel and vanadium-chrome steel under different modes of heat treatment, as annealing and oil tempering, and for the introduction of the special tool steels required to work them.

Before the special alloy steels were brought out, the motor-car manufacturers nearly reached the end of their resources in the effort to produce safe, durable cars of satisfactory power and speed without excessive weight. The transformation that has been wrought can be better comprehended when it is shown that it is not uncommon for specially treated chrome-nickel or vanadium-chrome steel to show a tensile strength of more than 200,000 pounds per square inch as compared with 50,000 pounds tensile strength of fibrous iron of a quality used by wagon makers and also employed for certain purposes in automobiles. That is a bar of the alloy steel one inch square is capable of sustaining a load of 100 tons without breaking. The qualities most sought in metals for sliding gears, crankshafts, camshafts, driving and differential pinions and gears and live rear axles are elasticity to resist torsional stresses and impact, hardness to resist wear, and ductility to bend under heavy shock instead of snapping. But ductility must be subordinate to elasticity, as it was found in the earlier days of the industry that the soft Swedish iron and low-carbon Bessemer crucible steel would take a permanent set under the repeated shocks and stresses, and throw the shafts and gears out of alignment.

As a result of the employment of steel of such wonderful strength in the sliding-gear sets, by way of illustration, it is now possible to transmit the 40 and 60 horse-power of the modern touring car with smaller and lighter gear sets than were used in cars of 12, 15, and 20 horse-power five years ago, and that with much greater certainty against breakage and the practical elimination of the mangling of the ends of the teeth by meshing and of wear due to contact under load. By the similar use of special metals in all parts of the machine that must sustain heavy torsional stresses, frequent and heavy impact, or much friction, the designer has been enabled to keep down the weight while constantly increasing the strength and life of the machine as a whole. This accounts for the great speed, power, quick acceleration, perfect manageability, and the dependability and durability of the cars of to-day weighing little if any more than machines of a quarter or third the power and half the speed, built during the first half of the decade.

All this improvement in quality, plus infinitely more grace in general lines and in comfort to the passengers, and a complete equipment of folding top, wind shield, head lights, magneto, and other expensive fittings, is offered to the buyer almost at no advance in cost over the ungainly, uncomfortable, and poorly-equipped cars of six and seven years ago.

The high steam shovel record for August on the Panama Canal excavation was made by a shovel working in the Culebra District, which excavated [illegible] cubic yards of earth in twenty-six working days. A shovel working eight days in the Culebra District and eighteen days in the Empire District excavated 10,745 and 26,518 cubic yards, respectively, a total of [illegible] cubic yards, the second best record for the month. A third shovel in the Culebra District made the high record for one day by excavating [illegible] cubic yards of rock and earth.

ENGINEERING.

The Jungfrau railway, which has formed the subject of illustration in this journal, is making steady progress. About 130 men are engaged on the tunnel between Eismeer station, 10,345 feet, and the Jungfrau Joch, 11,090 feet above the sea level. The present indications are that the road will be completed toward the close of next year

At the last meeting of the American Society of Naval Architects and Marine Engineers, in a paper on "Applications of Electricity to the Propulsion of Naval Vessels," Mr W L. R. Emmett estimated the efficiency of the turbo-electric installation at 92 per cent, and he, at least, is of the opinion that no other form of speed reduction between turbine and propeller can be made to show equal efficiency

In a recent article in one of the magazines, Admiral Evans takes a rather pessimistic view of the future of the Panama Canal He sees but little revenue in prospect, and apparently he holds the view that, unless the canal be declared free to all navigation, it will succeed in attracting but a limited amount of shipping He seems to be of the opinion that it cannot possibly charge a sufficient toll, at least during the early years of its operation, to pay the heavy fixed and operating charges.

A prize of $5,000 has been offered in England for a twenty four-hour aeroplane motor In weight the engine must not exceed 245 pounds, and it must develop not less than 35 brake horse-power The points to be considered in making the award will be weight, fuel consumption, reliability, wear of working parts, security against fire, and minimum air resistance The conditions are severe, but unquestionably the motor is the weak point in the aeroplane at the present stage of its development

Emphatic testimony to the ability of reinforced concrete to resist earthquake shock is given by the experts who were sent by the Japanese to Messina The buildings that had been constructed of armored concrete, according to Prof Amore, proved to be highly resistant, and much significance was attached to the case of two reservoirs of considerable size, one of brick and the other of reinforced concrete The concrete structure received no injury, whereas the brick reservoir was completely destroyed

Recently gathered steam turbine statistics, referring to the growth of this new type of engine in public favor, show that although the first steamer was equipped with turbines as recently as 1901 there are now sixty four vessels carrying this equipment, the aggregate horse-power represented being 603 200 It is estimated that because of the lower pressure which can be used with the turbine, no less than 120 tons of weight was saved in the boiler room of the largest of the turbine propelled liners

Statistics published by the Interstate Commerce Commission show that during two years, out of 152 preventable collisions and derailments, twenty-one of the accidents were due to the failure of the locomotive engineers to observe the signals Evidently the human element enters largely into the question of the efficiency of block signaling In view of this fact, it is encouraging to note the steady growth of automatic stop devices which, in case of failure of the engineer to obey a signal, will open the train pipe and set the brakes.

With a view to guarding the safety of passengers and preserving the life of rails and rolling stock, the Chicago, Milwaukee, and Puget Sound Railway will refrain from running high-speed trains over the new roadbed until it has had time to become thoroughly compacted and a reasonable amount of stone or gravel ballast has been tamped beneath the ties It takes some time for embankment and ballast to settle into place, and, apart from the risks of operation, the running of fast heavy trains over new track entails costly work in renewals and upkeep

Any one who was familiar with the appearance of the Niagara Falls before the present power installations were built and opened, can settle the question as to whether the appearance of the falls has been affected, by the simple expedient of going to see for himself Small though the total amount of water taken for power purposes, in proportion to the total amount passing over the falls, may be, it has been sufficient to cause the shallower portions of the overflow at the edges of the falls to become entirely dry, thereby greatly reducing the total length of the crest line

During the last month of 1909, electric service was inaugurated on the newly electrified portion of the London, Brighton and South Coast Railway, London, the particular portion placed in such service being known as the South London Line, which extends nine miles from Victoria to London Bridge Formerly the running time of this trip was thirty-six minutes; now it is twenty-five minutes, and trains run at ten-minute intervals. Operation is by the overhead alternating-current trolley, and the motor cars are each fitted with four 150-horse-power single-phase motors.

ELECTRICAL.

A recent press report states that a chain of wireless stations is to be established by the British Admiralty in the Pacific Ocean. High-powered stations will be placed at Sydney, Doubtless Bay, New Zealand, Suva, the capital of the Fiji group, and Ocean Island with medium-powered stations in the New Hebrides and Solomon Islands

A new device for connecting wires has just been put on the market It consists of a sleeve adapted to fit over the wires, which is filled with a requisite amount of solder The sleeve is furnished with material which when ignited produces sufficient heat to melt the solder The wires are then jammed together within the sleeve and firmly soldered in this position The device requires no torch or soldering iron, as the inflammable material can be ignited with a match The advantages of such a system of connecting wires will be appreciated by those who have tried to solder joints on overhead lines.

The voltage on power transmission lines has been rapidly increasing, and at such a pace as to almost take one's breath away This development has required a similar advance in the design of transformers capable of taking the high-tension current and reducing it to a lower and more serviceable voltage at the points of distribution The latest transformers of this type have a capacity of 3,750 kilowatts, and are capable of taking a maximum voltage of 138,500 and reducing it to 12,100 These transformers have been built for the Stanislaus Power Company of California Each transformer unit weighs about 28 tons complete stands 17 feet high, and occupies a floor space of 9½ by 5¼ feet

For the past three years meat has been cured by electricity in much less time than was required by the old method The meat is placed in large wooden tanks and covered with the ordinary pickle An alternating current of 35 amperes at 35 volts is passed through the vat, the alternations serving to prevent electrochemical action Carbon electrodes are used, which are surrounded by porous cups that dip into the brine The cost of curing a vat full of meat (four thousand pounds) is less than one dollar The action of the current is not perfectly understood but it appears to drive the pickle into the meat and hasten the cure It also appears to preserve the pickle and prevent its deterioration, except for the loss of ingredients taken up by the meat

According to La Lumière Electrique a new microphone has been constructed by Messrs Carl Egner and J Kannar, of Holmstroem, Sweden, which will withstand a current of ten to fifteen amperes The details of the instrument are not given out, owing to the fact that it has not yet been protected by patents The Swedish government recently connected several telephone lines, forming a line nearly nineteen hundred miles long, and the microphone transmitted speech very clearly over this circuit, whereas with the ordinary apparatus no audible sounds were produced The new transmitter is being used in the Poulsen wireless telephone system and it is claimed that conversation has been carried on over a distance of 175 miles, using a high frequency current of six amperes

The Navy Department is giving its earnest support to the bill introduced by Mr Roberts, who is a member of the House Committee on Naval Affairs, to control amateur wireless telegraphy Mr Roberts's measure calls for a board consisting of seven members, one expert each from the Navy, War, and Treasury departments, three experts representing commercial wireless telegraph and telephone interests, and one scientist who is well versed in wireless telegraphy and telephony It is proposed that the operations of the amateur telegraphers be confined to certain hours of the day, and that each operator be required to take out a license The Navy Department has recently forwarded to Mr Roberts extracts from the logs of revenue cutters, showing some of the difficulties with which naval wireless operators have to contend.

With characteristic thoroughness the Prussian Government Railways have been investigating the best roadbeds for their lines, also the best trolley systems and motors. About 20 miles from Berlin is an oval shaped experimental railway of about a mile in length Part of the roadbed consists of wooden ties, and another part of metal ties. Various kinds of ballast are used, and various methods of connecting the rails and ties. Over this experimental railway an electric train is operated every weekday for about twenty hours of the day, and in this way it is possible to determine which form of roadbed will best stand the wear of actual service. The overhead system has been changed from time to time, and different forms of collectors have been used. At present the locomotive on this line is being driven by Winter-Eichberg single-phase motors geared to the wheels. The company expects soon to use motors mounted on the floor of the locomotive, and crank-connected to the driving wheels.

SCIENCE.

A moving picture operator was taken up by Latham recently on a seven minute trip, at an elevation of eighty feet from the ground He took pictures with the lens pointing downward The apparatus weighed 200 pounds, and its operator 196

There seems to be some evidence that pulsatory oscillations of the earth's crust increase where there is a strong barometric gradient, without any relation to the wind The phenomenon has been investigated by two Japanese scientists, one of whom, Omori, has shown that the earth's pulsations are due to changes in the pressure upon the earth's crust caused by barometric changes or by accompanying changes in the sea level, but not due to the wind itself Shimono, the other Japanese, has carried on Omori's observations and made a special study of the case of August 4th 7th, 1909, when a depression approached Osaka from the south, finally passing off to the northeast. He obtained records of pulsations with components of 0 06 and 0 07 Other cases also support Omori's view

The blanket effect of clouds, their power of conserving terrestrial temperatures, is discussed by Mr W W Coblentz in a recent number of the Monthly Weather Review He says that this blanket effect of clouds is due to their high emissivity for radiations emitted by the earth and hence to their high efficiency as heat radiators A 'black body' should have no reflecting power and be opaque Water reflects only from 2 to 5 per cent of the waves received, and a layer 1 centimeter thick absorbs completely all radiation of wave length greater than 1 5 μ in the infra red The earth's maximum emission lies in the region of 8 μ, and less than 1 millimeter thickness of water is required to produce complete opacity in that region Owing to this opacity there is little internal reflection of heat waves in the water globule

The ironing of linen may have a greater effect than is expected of it As the temperature of the iron may greatly exceed 266 deg F it has been suggested that the process of ironing may suffice to sterilize surgical dressings and hence be of valuable service, especially in rural districts and elsewhere in the absence of disinfecting ovens and sterilizers Nearly all microbes can be killed by a sufficiently long application of a temperature of 158 deg F, but a temperature of 266 deg F is required to kill certain spores of bacteria and to produce absolutely complete sterilization It has been proved by experiment that it is possible to disinfect clothing very satisfactorily by ironing Clothing which had been worn by children affected by various contagious diseases and which contained bacteria of pus, diphtheria, etc was sprinkled and ironed It was then rubbed on plates of gelatine prepared for the culture of bacteria, but not a single colony was developed

Prof. Joly has studied the radio-active properties of the many lavas especially those of Vesuvius. From his results it appears that the Vesuvian lavas, from 1631 to the present day, are remarkably rich in radium compared with other lavas, the values ranging up to three times the normal for igneous rocks, and sometimes even higher than that The thorium content, although large in comparison with what generally prevails in the rocks of the St Gothard series, is not conspicuously higher in the Vesuvian rocks than in the rocks from other volcanoes The highest reading was obtained from the Krakatao pumice The Vesuvian lavas appear to show a progressive increase of radio-activity according as they are of more recent eruption, which seems to indicate that, as time progresses, this volcano is tapping materials richer and richer in radium Prof Joly has also discussed the possibility of a connection between radio-activity and volcanic activity

Not so long ago Prof Turner proved that gold leaf becomes transparent when heated in contact with glass This interesting phenomenon has been further studied by Messrs J C Chapman and H L. Porter without the use of glass In their experiments a piece of gold leaf was held by its edges to a platinum loop and heated in a double-walled quartz crucible As heating continued it was noticed that the gold leaf was becoming more taut, and eventually the tension became so great that the leaf tore in places Hence at a sufficiently high temperature gold leaf contracts On examining it microscopically after removal its structure appeared to be decidedly more granular Subsequent experiments with the leaf hanging like a blind with a weight at the bottom to put it under definite tension showed that as the temperature rose the contraction when it began took place at a great rate with increase in temperature When different tensions were employed the contraction temperature was nearly the same in all, and was about 340 deg C With gold wire instead of leaf no contraction took place The extra transparency when the leaf is heated in contact with glass is attributed to this contraction it being shown that the leaf tears on contraction at numerous places, leaving clear intervals between.

THE MOTOR CAR AND THE ROAD.

THE DESTRUCTIVE EFFECT OF HIGH SPEED.

BY LOGAN WALLER PAGE,

DIRECTOR OF THE OFFICE OF PUBLIC ROADS, UNITED STATES DEPARTMENT OF AGRICULTURE.

The most serious and difficult problem now engaging the attention of highway engineers all over the world is the preservation of the crushed stone road under the destructive action of motor vehicles, and the devising of new methods of construction adapted to the requirements of this twentieth century traffic. That the automobile has come to stay no one will dispute. It is estimated that there are already about 250,000 machines owned in the United States, and the number is increasing at a marvelous rate. In France, which is credited with having the most superb system of roads in the world, built at a cost of about $625,000,000, a great International Road Congress was sanctioned by the French government and held at Paris in October, 1908. So alarming were the ravages caused by motor traffic on the costly French road system that the purpose of the meeting was announced to be "The Adaptation of Roads to Modern Methods of Locomotion." In the United States, the problem as yet is a vital one only near the great centers of population, for the reason that but a small percentage of the total mileage of roads is improved, and the motor traffic is largely confined to small areas of country, but it will of necessity become increasingly important with the constantly increasing use of the automobile.

The fact that must give us concern is that the old methods of construction which have stood every test for more than a hundred years are inadequate to meet the conditions of this new form of traffic, and that we are in the midst of a transition period which may eventually revolutionize the science and art of the road builder. The highway engineer of to-day is called upon to ascertain in what way the automobile injures the road, what is the exact cause of the injury, and finally to devise an adequate remedy.

When Trésaguet, the great French engineer, made his report to the Council of Bridges and Roads in 1775, he set forth the principles of construction which, as modified and added to by John L. MacAdam in the early part of the nineteenth century, have proven adequate until the twentieth century. These great road builders and their successors sought to secure a road capable of withstanding the wear of iron-tired horse-drawn vehicles, for the motor-driven vehicle had no place in their philosophy. They worked upon the theory that the dust abraded from the crushed stone would fill the voids between the angular fragments and when wet would serve as a cement, thereby making the road surface practically a monolith. The iron-shod horses and the iron-tired wheels passing over the road from time to time were depended upon to wear off a sufficient amount of rock dust to replace that carried away by wind and water, and this, under the action of moisture, recemented, thereby automatically renewing the bond of the road surface. When the road was subjected to drought, the conditions were made normal by regular sprinkling. With the advent of the automobile, a totally new condition prevails. The rubber-tired wheels moving at excessive speed fail to produce any new dust from the rock, but the tremendous shearing effect of the driving wheels forces the loose dust on the road into the air in great clouds, and, as the body of the machine displaces a large volume of air, the deflected currents carry the rock dust off the road, thereby effecting a permanent loss of the all-essential binder. It follows that the road is soon stripped of its fine binding material, and the upper or wearing course of the stone is exposed. These stones, robbed of the binding material, are soon loosened by the great shear of the driving wheels, leaving the road badly raveled or disintegrated. It is, of course, apparent that the effects described are greatly intensified on curves where skidding is most frequent.

Highway and mechanical engineers have given much study to the action of the automobile on the road surface, and many ingenious theories have been advanced. While it is true that the slipping of the tire, the skidding, the shape of the car body, and the suction of the pneumatic tires all contribute to produce the effect, the most conclusive experiments seem to warrant the assertion that the great tractive force or shear exerted by the driving wheels of motor cars is the main factor of injury. A series of tests conducted by the United States Office of Public Roads in 1908 produced some interesting results along this line. Cars of various weights and types were run over a measured course at different rates of speed and right-angle photographs taken of each run. A 60-horse-power car stripped for racing, weighing with driver and mechanician about 2,800 pounds, was driven over a stretch of road first at five miles an hour, each run being increased at the rate of five miles an hour until a speed of 80 miles was attained. Up to 20 miles an hour little or no effect was produced on the road, but from 20 miles an hour the effect was striking with each increase in speed. Little or no effect is produced by the front wheels. Practically the entire disturbance of the road is produced by the rear or driving wheels. If the effect were produced by suction or vacuum, the action of both front and rear wheels should be somewhat similar at least. It seems apparent to the writer, therefore, that the road best adapted to motor traffic is the road which will best resist this powerful tractive shear. It has already been demonstrated that no plain macadam road is capable of resisting this force.

While the destruction of the road may be considered as the most tangible and serious problem, the dust nuisance as intensified by motor traffic is most far-reaching in its indirect effects. It has been claimed that nine-tenths of the dust produced by man comes from streets and highways and someone has very aptly termed the public road the "national dust factory." The effect of the huge clouds of dust upon health must be very great, as most forms of disease are transmitted by this germ-laden dust. The damage to crops growing adjacent to the public highway through the dust nuisance is real and tangible, and particularly is this true of small fruits. So extreme has this condition become in certain districts that no attempt is made to raise fruit near dusty roads. Its effect upon some classes of live stock is most severe, cattle and horses in particular being susceptible to the germs of tuberculosis carried by the dust. The automobile cannot be held responsible for these forms of damage, but it has undoubtedly intensified them. The road builder is, therefore, called upon in many cases to mitigate the dust nuisance by devising a form of treatment which might be considered a palliative.

The efforts of progressive highway engineers are directed, therefore, primarily toward the preservation of our stone-surfaced roads and the construction of dustless roads, and secondly to minimizing or mitigating the dust nuisance. The results so far accomplished have been for the most part experimental, and but little attention has been given to the actual composition and characteristics of the materials employed.

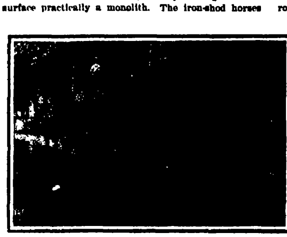
It is evident from even the slightest consideration of the subject that the solution of the problem must come, for the most part, from the highway engineer rather than the automobile manufacturer and the legislator. Manufacturers have, to some extent, tried to reduce the dust-raising tendency of their machines by various mechanical devices. Experiments in England brought out the fact that cars fitted with bodies having either very great or very slight clearance raised less dust than those with an average clearance. Some novel devices were tried with more or less success, the

Twenty miles an hour.

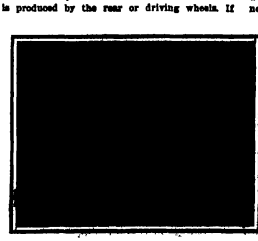
Thirty miles an hour.

Eighty miles an hour.

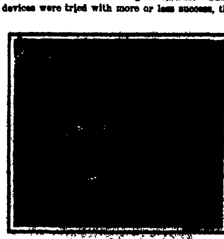
THE DISINTEGRATING EFFECT OF AN AUTOMOBILE TRAVELING ON AN ORDINARY MACADAM ROAD AT DIFFERENT SPEEDS.



SPRINKLING TAR ON A ROAD AT JACKSON, TENN.



WAGON FOR FORCING BINDER INTO A ROAD.



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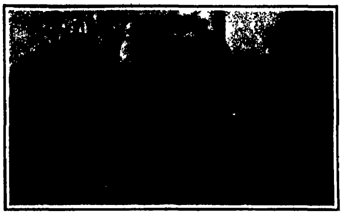
best results being obtained from a car with a flat steel bottom overlapping the sides of the car, and shoes instead of mud guards. The under screen was six inches from the ground and projected beyond the radiator in front to catch deflected wind from the faces of the car and pass it between the screen and the car, instead of between the car and the road. It is an evident fact that the greater the speed the greater the amount of dust, and the greater the damage to the road. Steps have already been taken to combat the speed mania by the enactment of the most stringent speed regulations. Much difficulty is found, however, in enforcing these regulations.

The experiments conducted by highway engineers, particularly in France, England, and the United States, have been directed toward providing a stone-surfaced road with

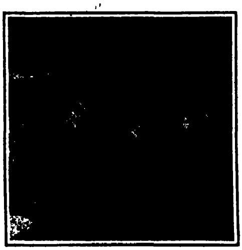


CONSTRUCTION OF BITUMINOUS MACADAM ROAD BY PENETRATION OR GROUTING METHOD. HEAVY TAR IS APPLIED ON THE TOP COURSE OF STONE

a binder more powerful than the rock dust. For the purpose of presenting intelligently the experiments thus far conducted with special binders, the term dust preventives' has been applied to all of the various binders having for their object either the suppression or the prevention of dust. These may be divided into two classes, temporary and permanent. The temporary binders serve merely as palliatives and require frequent renewal, the permanent binders, so called, enter into the structure of the road as a constituent element, and are either incorporated with the other materials at the time of the construction or applied later by a surface treatment.

In the class of temporary binders may be included water, salt solutions, light oils and tars, and oil and tar emulsions, while the

(Continued on page 65.)



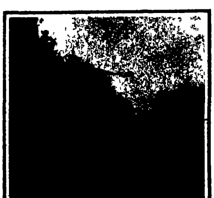
MIXING A BATCH OF MATERIAL OFF THE ROAD BY HAND MACHINE.

BITUMINOUS BINDER APPLIED WITH BROOMS FROM STEEL WHEELBARROWS.

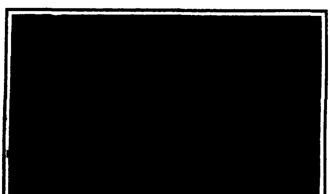
TARRED STONE DELIVERED ON THE ROAD ON PREVIOUSLY COATED WORK

HAND MIXING OF BITUMINOUS BINDER ON THE ROAD.

SMITH CONCRETE MIXER USED FOR MIXING ROAD-MAKING MATERIAL.

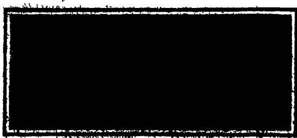


AN OBJECT LESSON ROAD AT UNIONTOWN, ALA.



APPLYING SPECIAL TAR BINDER AT WESTWOOD, MASS.

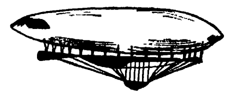
SUBGRADE COURSE BEFORE ROLLING



[illegible] THE [illegible] OF A "[illegible]" ROAD [illegible]. THE [illegible] OF THE ROAD REFUSES TO COMBINE WITH ANY [illegible] THAT MAY BE APPLIED.

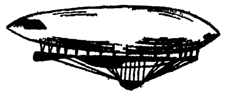
ROAD IN FAIRMOUNT PARK, PHILADELPHIA, AFTER BEING SUBJECTED TO SPEEDING AUTOMOBILES.

APPLYING A FINAL COAT OF TAR TO A ROAD BUILT ESPECIALLY FOR HIGH-SPEED AUTOMOBILE TRAFFIC.



MOTOR BALLOON GUNS.

AUTOMOBILE VS. AIRSHIP



It is to their credit that the manufacturers of artillery should so earnestly have grappled with the new problems presented by the development of successful aeroplane and dirigible balloons and so quickly have designed special ordnance to meet the new form of warfare The firm which has been most active in this direction is the great Krupp Company, in having brought out several types of gun, capable of firing at the high angles which will be necessary in order to hit the rapidly moving airships and planes of the future Because of the extreme mobility of the new method of attack from the air, it is obviously necessary that the means adopted to resist it shall be capable of a corresponding mobility This is especially true where the warfare is likely to be carried on against more or less rapidly moving bodies of troops

Now the automobile because of its speed weight, and strength, is particularly adapted, not only for carrying light automatic guns but for affording a platform from which they may be fired with a reasonable degree of accuracy Indeed the artillery motor car armor-plated and carrying a gun that is locked firmly to its chassis, is the natural counterpart of the familiar armored train running on the rails of the regular steam railroad And although the military automobile will be largely restricted to the roads, and will leave them only under exceptional conditions of smooth and fairly level country, the automobile balloon gun will find a field of usefulness in future campaigns whose limits can only be determined by the hard experiences of a regular campaign.

Of the three rapid fire-gun motor cars herewith shown, one is American and the other two are of German make One of our illustrations shows a rapid fire balloon gun, mounted on an armored motor car of 60 horse-power The latter, in spite of its weight of three and a quarter tons, is capable of making a speed of 45 kilometers per hour and mounting grades of 22 per cent, even when the roads are of poor quality The gun is also shown mounted on a semi-armored car This effective weapon has a muzzle energy of 24 8 meter tons and an extreme range at an angle of 43 degrees of 7,800 meters At the maximum elevation of the gun, the shell has a maximum height of trajectory of 3 800 meters

The armoring of the motor cars consists of nickel steel plates, 3 millimeters in thickness, and the gun itself is provided with a special shield capable of a wide arc of aiming The wheels, also, are covered in with nickel steel plating The ammunition is carried in a box underneath the back seat, and it will be noted that the front of the car is provided with slits for riflemen

The guns are provided with shells of a special design, suitable for attacking the gas bag of a dirigible or the canvas or rubber-cloth covered surfaces of an aeroplane To assist in tracing the flight of the shells, they are furnished, at the base, with a smoke-producing substance which is ignited at the instant of firing the gun, and emits a distinct trail of smoke during the flight of the shell This gives the gunner some indication of the error in his sighting

But it will be a very difficult matter to score upon a fast flying machine speeding mile-high above the earth The most promising form of attack is with shrapnel, which, if burst at the right distance in front of the object, will envelop it in a perfect spray of jagged shell fragments

Another illustration shows the McClean-Lissack automatic rapid-fire gun, as mounted on a 3-ton Packard truck, for tests which were carried out last year at Cleveland, Ohio. Lieut-Col O W Lissack, of the Ordnance Department of the United States army, and Dr S W McClean, designer of the gun, had charge of the tests, being assisted by the Standard Automobile Company, the Cleveland dealer for Packard motor cars and trucks.

HEAVY McCLEAN-LISSACK AUTOMATIC GUN MOUNTED ON A PACKARD 3-TON TRUCK.

The gun fired 3-pound shots at the rate of 100 per minute, the range being 3½ miles. Shots were tried with the brakes of the car set, and also released When the brakes were set the truck did not move, and no shock was felt by those surrounding the gun on the truck platform. With the brakes released there was a slight movement on the recoil, but no shock. The designer of the gun recommends its use on a truck such as the Packard, but armored for war purposes.

We hope to publish additional information regarding the results of additional trials of this gun, which are being made at Sandy Hook and Springfield for the army, and at Indian Head for the navy

The Middle West and the Automobile Industry.

BY ALFRED REEVES.

Michigan leads all States in motor-car manufacturing, for that State will make 112,000 of the total production of 202,000 cars scheduled for 1910. Four other States adjoining will contribute 70,075 machines. The Middle West may therefore be said to be the real home of the automobile industry Illinois is scheduled to make 15,300 cars in 1910, Indiana, 21,025 cars, Ohio, 22,750, and Wisconsin, 11,000 In the East, Connecticut will make 2,100 cars, Massachusetts, 4 100 cars, New York, 10,400 cars, Pennsylvania, 3,250 cars, and Rhode Island 800 cars.

These figures are taken from statistics obtainable in connection with eighty of the prominent automobile companies, and are startling to say the least, both as to their bearing on the location of the motor car industry, and on the importance of the automobile industry as a whole In addition, it must be remembered that there are fifty other firms making 100 cars or less, with 150 makers turning out a few cars or experimenting

Just why the middle West should lead in motor car manufacture is worthy of some consideration, especially when it is remembered that much of the early experimenting in motor cars and early manufacturing was done at plants in Buffalo and Tarrytown, N Y, Marion, N J, Bridgeport and Hartford, Conn, Philadelphia, Pa, and other Eastern States.

Because of the tremendous growth of the industry in the past ten years, and the amount of capital and number of people employed, the settlement of an industry like that of automobile making in any particular section of the country, is a condition worthy of thought. The middle West may be said to be in control of the situation, not alone in the making of cars, but in the making of tires, parts, and accessories For this condition, we must first give credit to the industrial enterprise of the middle West, for the securing of big factories, for the enterprising methods of its boards of trade, and for the readiness to contribute money toward the securing of new industrial enterprises, like that of motor-car building Next must be considered the labor situation, which is excellent in the middle West, especially in the matter of hands for automatic machinery Most of the big machinery making companies are in Ohio or Indiana, where machinists of excellent character are to be had in large numbers.

Besides being the center of the machinery trade, the middle West has been the headquarters for raw material to a very large extent, at least after it has been put through its first or second process, as in the case of rubber, steel, leather wood, brass, and other things used in the modern motor car

More important than all is the fact that the middle West is the center for transportation, a most important item when the matter of freight on automobiles is considered. Because of their high value, automobiles contribute very heavily to the railroads, and the matter of freight on incoming material or outgoing cars for an extra thousand miles or so, means an add of cost which every manufacturer tries to avoid. While it is true

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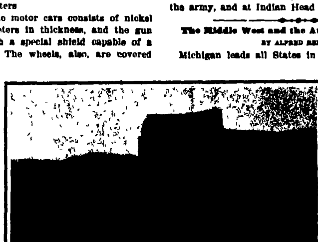
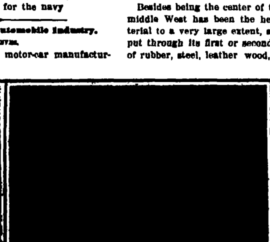


BALLOON-ATTACK RAPID FIRE GUN, WITH SHIELD, MOUNTED ON COMPLETELY ARMORED CAR. WEIGHT 3¼ TONS.



THE SAME GUN MOUNTED ON A SEMI-ARMORED CAR. NOTE THE SHEET-METAL BODY.

ANTI JOY RIDE DEVICES.

BY HARRY WILKIN PERRY.

So great a proportion of the many fatal or otherwise very serious automobile accidents chronicled almost daily during the motoring season is the result of the use of cars without the owners' knowledge or consent, that it seems as if the time has come when the public welfare demands the general equipment of automobiles with some means whereby the unauthorized use of machines can be positively prevented. If matters continue as they have, it will become incumbent on every law-abiding and gentlemanly owner of an automobile to adopt voluntarily such protective measure, even if laws compelling it are not enacted for the public welfare.

"Joy riding"—as the wild running of a motor car by a partially inebriated driver accompanied by several hilarious companions has come to be called in the automobile vernacular—is of several kinds. It may be indulged in by the lawful owner or rightful user of the machine, by skylarkers passing through the streets and finding an unattended automobile standing by the curb which can be appropriated, and by chauffeurs employed by the owner or by employees of the public garage where the car is kept, who take it out, usually at night, without the owner's or the garage proprietor's knowledge.

Laws have existed for some years in a number of States making it a misdemeanor for anyone to meddle with an automobile standing in the street, and prohibiting users of motor cars from leaving their machines unattended with the engine running. During the past winter there has been much activity in legislative circles for the enactment of laws to prevent "joy riding." The New York Legislature passed a bill containing a provision prohibiting anyone from using or tampering with a motor vehicle without the owner's consent, under penalty of a fine, imprisonment, or deprivation of the right to use the public road for six months, or any or all such penalties. The Colorado Legislature passed a bill to go into effect and be enforced immediately upon its passage, as "in the opinion of the General Assembly an emergency exists," prohibiting any person from tampering with or entering or starting any motor car without the knowledge and consent of the owner or owners, whether an individual or a corporation, and fixing the penalties for infraction at a fine of not less than $50 nor more than $300 or imprisonment for not less than 30 days nor more than 90 days or both such fine and imprisonment.

Such laws will doubtless have a deterrent effect, but they are difficult of enforcement and are punitive rather than preventive, applying the punishment after the evil has been committed. The abuse of automobiles as distinguished from their proper and most desirable use has reached such serious proportions as to call for the general application of mechanical and automatic means whereby the unauthorized use of a machine can be positively prevented or detected the first time it occurs and the punishment made to follow swiftly upon its commission.

Inventors have wrestled with this problem for several years, and a variety of devices have been put on the market to fulfill the desired ends. The difficulties in the way of producing a device that will act as a certain check on the use of the car and yet enable the chauffeur or the mechanic to clean and adjust the engine, test the ignition and generally keep the car "tuned up" to maximum working efficiency are numerous and complex. Chauffeurs and machinists are clever and resourceful or they are unworthy of their hire. A nail, screw, or piece of wire can be made often to take the place of a removable switch plug or the star wheel or spur gear that drives the flexible shaft of a recording instrument can be disconnected. Again, if any operating part of the motor car is positively locked against action, such as the wheels, steering gear, or transmission, it may be difficult to move the machine about in the garage, as frequently becomes necessary for washing, repairing, or in event of a fire when all the cars have to be hurriedly pushed into the street.

Mechanical devices that have been invented with the object of affording partial or complete protection to the owner against the unauthorized use or overspeeding of his car may be divided into groups as follows:

1 Devices to prevent the engine from being started when the car is left standing in the street, embracing (A) ignition switches with removable contact plugs, (B) ignition switches that can be locked in inoperative position.

2 Devices to lock essential operative parts, embracing (A) steering wheel lock and (B) speed change lever lock.

3 Speed limiting devices, embracing (A) instruments interconnected with a speedometer and the spark or throttle control so that a given speed cannot be exceeded, (B) audible signals sounded automatically when a predetermined speed is attained, and (C) speed indicating devices with large dials prominently placed so that they can be read at a distance by policemen and others.

4 Vehicle movement recording devices embracing (A) vibration recording instruments of the pedometer type, and (B) clockwork registers in which permanent records of the time, extent and rate of movement are

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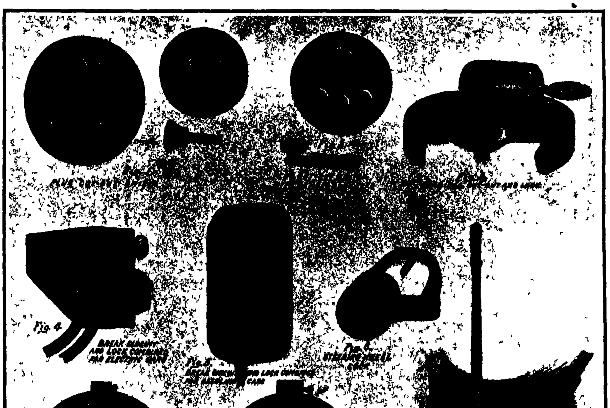


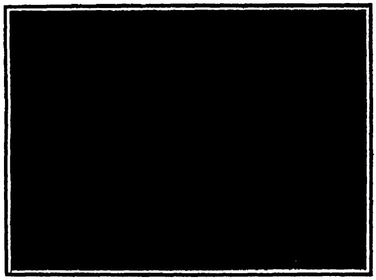
ANTI JOY RIDE DEVICES.

WHAT THE MOTOR VEHICLE IS DOING FOR THE FARMER.

BY WALTER LANGFORD.

Less than five years ago farmers generally looked upon the automobile with bitterness and condemned it as a "toy of the rich." To-day, there are farms comprising hundreds and even thousands of acres, on which nearly all of the heaviest work is done by motor vehicles. There is hardly any part of farm work that cannot be done more quickly and with greater satisfaction by the use of motor power—either applied to a self moving machine or in the stationary form—than with horseflesh. Whether it is making a quick trip to town with a load of butter, eggs, fruit, or vegetables, to the creamery with the evening's cans of fresh milk, to church with the family on Sabbath morning, doing the spring and fall plowing, cultivating, reaping threshing—the motor vehicle in its varied forms has become the latest ally of the progressive prosperous farmer.

M'INTYRE HIGH-WHEELED MOTOR WAGON CARRYING A LOAD OF FARM PRODUCE.



CARRYING CRATED CHICKENS AND EGGS TO MARKET.

It has been a matter of general knowledge and common comment in automobile circles that extraordinary numbers of motor cars have been going into the remote sections of Kansas, Nebraska, Minnesota, the Dakotas, Colorado, and even Montana, Oklahoma, and Texas during the past season. The statement has been made by a man identified with the trade and presumed to be posted that fully one-quarter of the purchases of motor cars west of the Mississippi during the season of 1909 were made by farmers, and this means a good many when the combined output of the manufacturers of the country for the year aggregated in the neighborhood of 75,000 machines. Some of the little communities in the Middle West, with a population numbering only hundreds or at most a few thousand inhabitants have begun to boast of possessing more motor cars in proportion to population than any other city or town in the country, and to prove it, they congregate all the cars in the village in Main Street and have a group photograph taken.

The farmer, who has long distances to go for everything, from a keg of nails to a paper of tobacco, and who works early and late to make up time lost partly in going "to town," has not been slow to appreciate the luxury and time-saving ability of the motor car. He balances off the cost of a tenth or a twentieth of a gallon of gasoline per mile traveled against a third or half bushel of oats a day at 65 cents a bushel, whether the horse is working or is standing in the stall on a rainy or a winter day, and reckons the time saved to himself as mainly pure gain.

Scattered all the way from the Atlantic to the Pacific coasts there are small fruit and vegetable growers, dairy farmers and poultry raisers who make a daily practice of carrying light loads of produce to market in the tonneau or on the rear deck of ordinary light touring cars. They can leave the horses to work in the field and can make the trip in a third or quarter of the time formerly consumed thereby gaining just that much additional time to be devoted to more work or to reading, visiting, attendance at concerts, lectures, etc.

The ordinary four or five-passenger touring car of moderate power and reasonable price is most extensively used by farmers. Some of the accompanying illustrations show how such a car is put to practical uses on the farm with the rear seat removed. This is the general utility automobile of the agricultural sections and is used for a great variety of purposes. With it the farmer drives out to his grain field to superintend the threshing, runs down to the pasture with a reel of wire to repair the fence, runs into town with the horses' collars and harness to have them mended, carries cans of milk to the creamery or crates of live poultry to the express office.

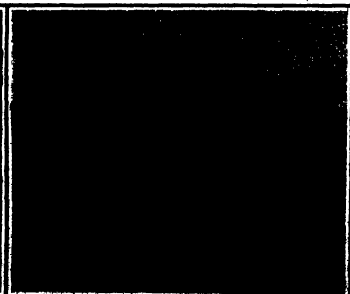
Observing the growing demand by farmers for a car for all-around work a wide-awake automobile manufacturing company in Kenosha, Wis., about two years ago began advertising in the farm papers a double-cylinder light touring car at a moderate price, and inside of a year had sold between 500 and 600 cars in the rural districts. There are now probably between 1,500 and 2,000 of its machines owned by men who live on farms practically all of whom use them as general utility machines. An easily removable tonneau, high clearance above the road, a thoroughly protected engine and transmission, reasonable price and low fuel consumption and maintenance cost have contributed toward making this model popular with the rural buyers. From the statements of hundreds of users, it is found that the average cost of upkeep is not more than two-thirds that of keeping a horse. The farmer of to-day is well informed regarding the mechanical features that adapt an automobile to his requirements and is a careful buyer. He can safely carry 500 pounds on the rear of a 20-horse-power car and can drive ten miles to town in from half to three-quarters of an hour with the load.

Largely as a result also of the farmers' demands there has been developed during the last three or four years a type of motor car called the high-wheeled buggy. There are upward of fifty companies in the country now actively engaged in building this style of motor car especially for use in country districts where the roads are rough, hilly, and, according to the season, deep with mud, sand, or snow. They are very low in price, simple in construction and operation, and answer the purposes of many rural dwellers very well. They use only about a gallon of gasoline to fifteen or twenty miles traveled, and a set of narrow solid tires, costing say $35, will wear a year or more with no expense for repair of punctures or blowouts.

Within a year or two there has been added to the two-passenger runabout and four-passenger surrey models a high-wheel open-bed light delivery wagon model, of the democrat wagon type, especially suited to farmers' use. A load of 500 to 800 pounds can be carried in the space beneath and back of the front seat, and in some makes an extra double seat can be set in the back to accommodate extra passengers when the vehicle is to be used as a passenger conveyance.

Other light work wagons with open-bed bodies particularly suited for agricultural uses but fitted with longer bodies and having a load capacity of 1,000 pounds or more and costing $1,000 and upward, are

AN AUTOMOBILE TRACTION ENGINE USED FOR DRIVING A THRESHING MACHINE.



A [illegible] HIGH-WHEELED FARM WAGON ON THE ROAD.

TYPES OF AGRICULTURAL AUTOMOBILES.

manufactured by several companies in Chicago, Syracuse, Elgin, Ill., Dowagiac, Mich., and Lititz, Pa. They are excellently suited to carrying to market good sized loads of vegetables, fruit, dairy and barnyard produce weighing from 1,000 to 2,000 pounds, and for hauling back loads of feed, fertilizer, fencing and building materials, farm machinery, and so on. The high wheels give the axles and driving mechanism a good road clearance, and the construction is of a heavy and durable as well as simple character.

Numerous cases might be given of motor cars put to special service in connection with farming. In Maryland there is a high-class dairy farm where motor delivery wagons are used altogether to distribute milk among the consumers in the vicinity, and in Indianapolis a large milk company is using a 1½-ton and a 3-ton gasoline truck in the collection of milk from dairy farms within a radius of twenty-five miles of the city, which was formerly shipped by the interurban electric railways or by horse and wagon. In England a large produce grower sends his fresh vegetables to market in a huge motor van, the roof and tailboard of which, as well as the inside, are piled with green goods. These examples seem to foreshadow the time, not very distant, perhaps, when farmers will find it cheaper and more convenient to ship all of their farm products to market on motor trucks than to haul them with horses and wagons. Possibly the trucks will be owned by local express companies organized for the purpose, which will charge a reasonable price for haulage, so that it will pay the farmer better to keep his horses—if he needs any then—at work in the field, and he will not need to invest any capital in the motor trucks. Doubtless some of the transporting companies will use motor tractors, which will run over regular routes every morning and pick up a string of farm wagons loaded with produce, hauling them to market and back again for a fixed charge. A single tractor should be able to haul four or five such wagons over good roads.

In Connecticut a three-ton truck is regularly used for hauling grain and carrying all sorts of farm supplies and products for a 1,300-acre farm. This is one of the many fancy estates conducted in the East by wealthy owners largely as a personal hobby yet at the same time as a profitable investment. The truck represents an outlay of $5,000 and is kept in a special garage for work motor vehicles which are to be used extensively on the farm.

A ranch of several thousand acres in Montana is conducted entirely without horses, the plowing, sowing, cultivating, reaping, threshing, and hauling of the grain to the railroad being done by motor tractors and motor wagons. We have had the horseless street car for twenty years, the "horseless carriage" for ten, and now we have the horseless farm. May we hope some day for the horseless city?

While the foregoing examples are isolated cases and apply to farming on an extensive scale with ample capital, they point to great possibilities for the future use of self-propelled vehicles in farm work, utilizing gasoline, kerosene or denatured alcohol as fuel. The farmer with a small acreage who would not be justified in buying a motor tractor for his own use, will be able to hire his plowing and threshing done by companies operating motor tractors, as for many years he has had his threshing done by itinerant steam threshing outfits. And, incidentally, the work will be done cheaper, there will be no danger of fire from flying sparks, there will be little or no water to haul, and there will be fewer men to feed.

In this country, as well as in England and France, there are large companies that make a specialty of building small farm tractors for universal tractive and stationary power work. A company in Minneapolis makes an 8 horse-power tractor weighing 5 500 pounds for such work as operating hay presses corn shellers etc. and for drawing wagons and portable machines of this class on the road. In York, Pa., is another large company that makes motor tractors and traction engines in ten sizes, from 1,000 to 36,000 pounds in weight. The smallest is rated at 1½ to 2 horse-power and is intended for all sorts of farm work such as hauling the stone-boat, churning, pumping, feed cutting, etc.

AN AVERY FARM TRUCK HAULING SCRAP.

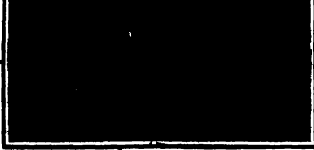
American motor tractors used for plowing and threshing usually develop from 12 to 35 horse power and weigh from 5 000 to 20 000 pounds. They haul gang plows turning from two to eight furrows at a time. One of these—a 15-horse-power tractor built by the largest harvesting machinery company in the world—plowed 1 09 acres of "gumbo" soil with a three-furrow 12-inch bottom plow in an hour and a quarter on a consumption of 1½ gallons of gasoline per acre at an international competition held in Winnipeg last July.

A "wagon tractor," built in Peoria by a great agricultural implement works for general utility purposes in the field and on the road, was tested at the same trials. Coupled to a two-furrow 14-inch gang plow, it turned over 1 06 acres in 1 hour 25 minutes on a consumption equivalent to 3 38 gallons of gasoline per acre. This would amount to about 50 cents an acre for fuel. In a ten-hour day 7½ acres could be plowed for about $3 25, not including labor.

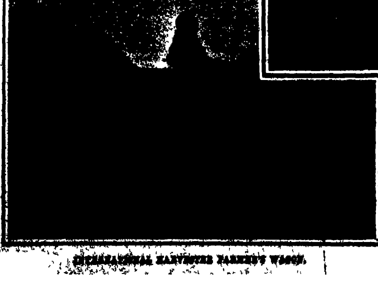
This wagon tractor is a very interesting vehicle. It was designed particularly for farm purposes by men who are familiar with the peculiar requirements, and combines in one machine a truck for carrying loads on its own body, a tractor for drawing plows and other farm machinery, and a power plant for driving threshing machines, hay balers and other stationary machinery by belt. It will take the place of several teams and wagons on the farm.

Nowadays, on the farm as well as in the manufactory it is necessary to do the largest amount of work in the shortest time in order to make an undertaking successful. This is recognized by the progressive farmer and farm machinery builders and to a large extent the advantages of the motor car and motor tractor are appreciated by builders of farm wagons and buggies. Most of the leaders in these fields are now offering their customers a motor buggy, a motor car, a motor wagon, or a motor tractor.

WITH A REEL OF WIRE FENCING AND A BOX OF TOOLS ON THE REAR DECK THE PASTURE FENCE IS QUICKLY REPAIRED.



HALF A DOZEN CANS OF MILK ARE TAKEN TO THE CREAMERY AND THE EMPTY CANS BROUGHT BACK.



INTERNATIONAL HARVESTER FARMER'S WAGON.

The Modern Electric Automobile.

BY EMIL GRUENFELDT, M.E., E.E.

The heavy cumbersome electric cab or brougham of earlier days has cleared the field for the light runabout, victoria or interior driven coupé. Less weight means more speed and a greater mileage radius. It was looked upon as a great performance when one of the earlier types of electric automobiles traveled forty miles on a single charge of the battery at a comparatively low speed. The modern electric automobile will negotiate about twice the distance at a much greater speed. The most vital components of an electric automobile are the motor and controller, two parts which are of different design on about every other make. For its various advantages the series-wound motor has outclassed its rival of the earlier days, the compound motor. The series-wound motor, if properly designed, will do its work for three hundred and sixty-five days in the year without requiring any attention. The most desirable motor is not that which tends to drive a car up a hill at a comparatively high speed. A heavy battery discharge is thus entailed, which is of course very detrimental to the battery. Of two cars traveling at the same speed on the level, that one will travel the faster on a grade whose controller was not changed. The motor of this faster car is designed for a smaller increase of torque in proportion to the decrease of the speed. Even if this difference in speed is very small, say one-half mile an hour, the faster car will have to pay dearly for it in current as well as in decrease of mileage radius and in battery wear. The good designer will find a middle way. He will strive for the highest battery efficiency. It is by no means difficult to construct a fast electric, as the power is unlimited for a short distance. The art is to apply the power at disposal in the most all-around satisfactory way and to design a carriage which is reliable and cheap to maintain.

In the line of various controllers the drum type for good reasons seems to have grown into great favor. The various speed changes can be obtained without arcing or burning, and a gradual increase of speed is effected from step to step with a small increase of

(Continued on page 68.)

THE MODERN LOW-PRICED CAR.

BY JOSEPH ROGERS.

The automobile buyer faces no such questions in 1910 as confronted him a few years ago, when all that was expected of a car was that it would run. At that time the gasoline engine was not understood as the engineer understands it to-day and all of the parts and appurtenances were undergoing a process of evolution that resulted in vast differences between the models of two successive years. Each make had some peculiarity of design, and the selection of a car was complicated by the difficulty of getting definite information on performance.

There were reliable cars, of course, but their initial cost and the expense of operation made their ownership possible only to the very well-to-do. The car that could be bought by the man of moderate income required close attention and the adjustments and repairs that were a constant necessity left him little time for anything else. If these were in the hands of a repair man the monthly bills were out of all proportion to the mileage covered and the pleasure obtained. Automobiling at that time was unquestionably a diversion for the rich, and it is popularly supposed that such is still the case, but as a matter of fact, the man of moderate income can to-day purchase and use a car at an expense that is well within the bounds of reason.

The primary cause for this is found in the relatively close understanding of engine and car design that obtains to-day. The systematic experimental work that has been carried on in the large factories has resulted in a refinement in design and an approach to a standard that place automobile manufacturing on as economical a basis as is possible in the production of any other mechanism.

The moderate price at which an automobile may be bought is not due to the use of poor material and cheap labor, on the contrary, the low-priced car of to-day is better in quality than the highest grade cars of six years ago.

In the early days of the automobile industry the manufacturer was under the necessity of making all of the parts, to-day, the factories actually making even 75 per cent of the parts that they use are in small proportion to the number of producers. A few years ago, when a manufacturer purchased his engines, change speed gears or other parts, he concealed the fact, to-day, a constantly increasing number of firms make it no secret that their cars are assembled in whole or in part. It is to these changes in policy that the excellence of the medium-priced automobile is largely due.

The manufacturer of a complete car is under the necessity of maintaining an experimental department in which he can try out suggested improvements on all parts of the chassis. This is expensive work, and a proportion of the cost of the department must be included in the price of every car sold. The maker of an assembled car is under no such handicap, for each of the firms with which he does business will carry on only such experimental work as is required for its special line, and the expense is borne by so great an output that the individual proportion is negligible.

There was a time when an assembled car was undoubtedly open to suspicion, for however desirous the makers of its parts might be to do good work they had neither the knowledge nor the facilities that would make it possible. These same companies now possess enormous plants, their designers and equipment are the best obtainable, and their products embody the latest and best in practice material and workmanship. Assemblers thus have parts at their command that are of a high degree of excellence, and can buy them at prices that are far below what was charged for the weak and faulty product of former years.

The low prices at which assembled cars can profitably be sold have forced the builders of cars of competing grades to manufacture on a very large scale, in order to bring down costs through economies possible only with quantity production. Such a firm equips its factory with jigs and special tools for every operation, and makes it an inviolable rule to accept no order that calls for even a slight deviation from the standard specifications.

When a manufacturer turns out twenty thousand cars a year, it is not only justifiable but necessary for him to invest very considerable sums in special machinery of all kinds that for a smaller output would be inadvisable. One manufacturer has spent $40,000 for dies to produce a rear axle housing, on a production of one thousand cars, the charge against each for this would be $40. With an output of twenty thousand cars, however, the charge of $2 against each is little enough for the purchaser to pay for so excellent a feature.

A recent development that illustrates the endeavor to reduce manufacturing costs is the establishment by some of the leading producers of assembling shops at the large centers. To these are shipped parts in sufficient quantity to build the cars required for that locality, and as there is no equipment of machine tools, the expense is slight. The freight rate on unassembled parts is much lower than on complete cars, and the saving effected in time and convenience as well as in money makes the system a satisfactory one.

However it may have been in the past the present day manufacturer of moderate-priced cars makes no more than a legitimate profit. One of the largest producers stated recently that his profit on a $1,000 car is less than $100, this is not excessive when one considers his enormous investment in material and parts, his really vast equipment of machine tools, and his labor expense.

It has been said that any average engineer can design a car to sell at $4 000, but that the greatest skill is necessary when the selling price is to be less than $1 000. However that may be, the medium and low priced cars on the market show exceedingly clever designing and bear every indication of the highest grade of mechanical engineering. Being light in weight, the material entering into their construction is selected with the greatest care, and it is typical of the automobile industry that many of the alloy steels in common use were hardly more than laboratory curiosities five years ago.

The whole tendency of design is to reduce weight and machinery and assembling costs, but it is rare to see a case where strength and durability have been sacrificed for economy. One of the features of the 1910 cars is the casting of the four cylinders in one piece, which results in a considerable saving in weight and cost, with no apparent reduction in strength or ability. The increasing tendency to adopt the gravity system of water circulation is another economical move, for it permits the suppression of the pump. The mechanical lubricators that were formerly in general use have been abandoned in favor of a single pump located in the crank case which is not only less expensive to build and assemble, but makes lubrication as positive and unfailing as it well can be. The magneto is now the standard equipment even for cars of very low price, and quite frequently it is the sole means of ignition. An advantage that may be gained through its use is that the spark may be maintained at a fixed point, and therefore the spark control lever and its connections may be done away with. The locating of the clutch and brake pedals on the gear case reduces the cost of assembling, for when they are hung on a rod passing across the frame as was the practice in former years, accurate fitting is an absolute and costly necessity. When the engine, change speed gear and rear axle are separate units, assembling is complicated by the necessity for setting them accurately in line, in a great number of 1910 cars the change speed gear is either built in with the engine or the rear axle, and the cost of assembling is reduced in consequence.

In spite of the excellence of the 1910 cars, it must not be assumed that the limit of perfection has been reached. Some of the work turned out by the designers shows that they have followed a common path, but in many cases there are differences that are not easy to reconcile. The perfected car cannot come until the efficiency of one definite construction has been recognized, and its proper proportions demonstrated. The great variance in the designs of to-day is evidence in itself that there is still much to learn, for otherwise, as an example, there would be less difference in the dimensions of engine bearings than is now noticeable in different makes of engines of the same power. The relation of bore to stroke is the subject of a vast difference of opinion at the present time, and even the relative length of the connecting rod is by no means fixed.

Having produced cars that will run, and that can be depended on for steady service, the problems now before the designer have to do with the increase of efficiency and economy of operation. At the present time it is doubtful if any manufacturer knows what proportion of the power of his engine is absorbed in operating the valves, or in driving the magneto and pump, but these and other far more complicated details must be worked out in his future models.

If the principles of the present engine are adhered to, the coming years will bring a closer and more accurate knowledge of the cycle, and a general adoption of the features and relative dimensions that survive the ordeal of usage. For the car owner this will mean greater economy in the use of fuel, increased simplicity in construction, and the reduction in price that is the invariable result of standardization.

The Wright Suit and Aviation in America.

The granting last week by Judge Hazel of a preliminary injunction restraining Glenn Curtiss and the Herring-Curtiss Company from making, selling, or flying their well-known type of biplane has quite taken by surprise almost everyone versed in patent law, as such an injunction has been granted very rarely, if ever, before upon an unadjudicated patent. Even in the case of the Selden patent covering the use of a clutch between the motor and the road wheels of an automobile—a case in which an infringement was much more apparent—such an injunction was not granted. The granting of the injunction at this time has had two results. In the first place it has intimidated a good many inventors who were hard at work upon the perfecting of the aeroplane, and secondly it has encouraged the Wrights to attempt the creation of a monopoly in flying machines. With a million-dollar company back of them, and with orders already booked aggregating more than this figure, the granting of the present injunction gives them practical control of aviation in America. A second step in this direction occurred on January 4th, when aviator Paulhan was served with a notice to appear in the New York District Court ten days later to show cause why he should not be enjoined from flying his Farman biplanes in the United States. As he is booked to make flights at the Los Angeles aviation meeting from the 10th to the 20th, this action may be a serious blow to the first aviation meet held in this country.

The death of Leon Delagrange from a fall sustained as a result of the breaking of a wing of his Bleriot monoplane while flying in a 20-mile wind at Pau, France, on the 4th inst., has given aviation another setback that it will take a long time and many excellent demonstrations to overcome. Four lives lost within the last four months is a record by no means encouraging to sportsmen, and unless everything possible is done to encourage flight in this country, none of the aeroplane factories soon to be started will do much business for some time to come.

Hydrogen for Inflating Pneumatic Tires.

The inflation of an automobile tire with a hand pump is so laborious an operation that some automobilists carry cylinders of compressed air, with which a tire can be inflated easily and rapidly. The cylinders, however, may be found empty when they are most needed. Drouetly a French manufacturer of aluminium paper, has conceived the idea of replacing the air by hydrogen, generated by the action of water on specially prepared aluminium waste. In presence of alkalies, aluminium decomposes water into oxygen and hydrogen. The oxygen combines with the aluminium and the hydrogen is set free. The method of operation is very simple. About 10 ounces of granulated aluminium and 10 ounces of water are introduced into an air tube of the capacity (6½ pints) which is commonly furnished by the great tire makers, and the bronze plug is quickly screwed down. In a few seconds the space not otherwise occupied, about 5½ pints, is filled with hydrogen at a pressure of 150 atmospheres. This is equivalent to more than 100 gallons of hydrogen at atmospheric pressure. The other product of the reaction is alumina, which can easily be washed out. The special preparation of the aluminium consists in the addition of a small percentage of mercury bichloride which starts the reaction in the absence of alkalies so that pure water can be employed.

This method possesses two advantages. It allows every automobilist to recharge his air tubes without returning them to the factory. There is also a real advantage in inflating tires with hydrogen instead of air. The diffusion of gases through colloidal substances like India rubber follows a very different law from that which governs the diffusion of gases through porous walls. In the latter case the rate of diffusion is inversely proportional to the square root of the density of the gas, but the rate of diffusion through India rubber is directly proportional to the facility with which the gas can be liquefied. Hydrogen generated by the action of aluminium upon water was used for filling balloons in the Russo-Japanese war, but this ingenious and simple method of obtaining cylinders of compressed hydrogen appears to be as new as it is interesting.

To Americans who are accustomed to five-cent car fares, it will be surprising to learn, on the authority of The Engineer, of London, that last month there was inaugurated an electric-car service from one of the London subway (tube) stations to the suburb of North Finchley, on which a fare of half a cent will be charged.

HOW TO OVERHAUL A CAR.

BY HERBERT L. TOWLE.

In order of importance, the facilities needed for overhauling are a warm, light place to work, an extension electric light, a bench, several boxes for use as receptacles and supports for the dismantled parts, and as liberal an assortment of tools as the owner's means will permit. An iron vise, a bench drill, a foot or power lathe for metal work, and an emery wheel are almost necessary. Failing these, certain parts can be sent to the shop for refitting. A complete kit of bench tools is assumed—hammers, files, hack saw, chisels, wrenches, screwdrivers, cotter pin extractor, etc.; also a soldering torch.

The first step after washing the car is to strip it of lamps, mud guards, and small gear generally. If the screws and nuts are greasy drop them into a pan of kerosene. Have a large box handy for small parts, and three or four small boxes in it for the purpose of grouping related small parts together. It is very easy to get a car apart and shuffle the various bolts, washers, and other small things so thoroughly that it is impossible to tell where they belong on reassembling.

Ascertain by looking underneath whether the gasoline tank is attached to the body or to the chassis. If the former, disconnect the gasoline pipe at both ends, plug the ends with bits of rag, disconnect the horn tube and any electric wiring that may run from the body to the chassis, take out the bolts holding the body to the side and rear frame members, and lift the body straight up. The dash is a part of the chassis, not of the body, and does not need to be disturbed at this stage. Have a couple of wood horses ready to receive the body. Do not set it on the floor, as there may be parts projecting beneath it such as the gasoline connection beneath the tank.

The amateur is advised to begin overhauling in the order of ease rather than of magnitude. For this reason the brakes are suggested as a start. Inclosed rear brakes on a car with side chains are generally exposed by taking off the rear wheels. First, see if the brake drums have removable cover plates. If not, take off the sprocket chains, unscrew the hub caps and nuts, and the rear wheels will come off, leaving the expanding brake [illegible] in place and exposed. [illegible] whether or not the adjustment is near its limit. If so, replace the [illegible]. The foot brakes are adjusted or relined in the same way.

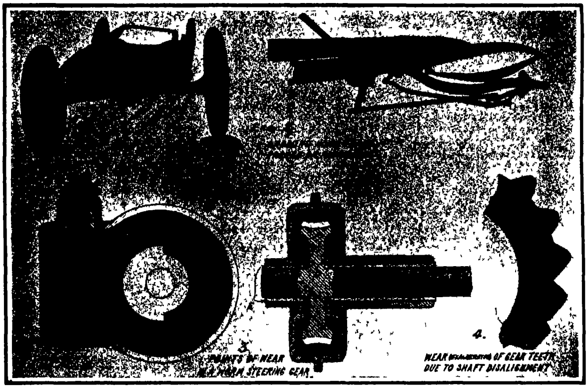
Remove the radiator, wash it out under a strong stream of water, and if it is suspected of being encrusted with scale fill it up with kerosene and let it stand—until spring time will do no harm. When reassembling it is important to give the radiator an even bearing around all four studs, supposing it to be held down by that number. If possible, have it rest on ⅛-inch sheets of rubber, and do not draw the holding-down bolts entirely tight. The radiator although frail, is much more rigid than the frame, and any springing of the latter will surely start leaks in the radiator if it has to follow it. The two sketches Figs. 1 and 2, show how a frame may be racked in going over a rough road. If the radiator leaks it is best to let an expert tinsmith repair it (not all tinsmiths are expert). The secret of success is to use a good grade of solder and sweat it thoroughly into the seams, taking plenty of time. If the top is not steadied it will be worth while to run a brace or stay rod to it from the top of the engine or the dashboard. This rod need be only heavy enough to check the vibration.

If there is much lost motion in the worm or other reducing gear of the steering mechanism disconnect the steering links, also the throttle and spark connections, and take the steering column out with the reducing gear at its base. Open the casing and see where the lost motion is. It may be in the threads of the worm A, Fig. 3, and the teeth of the segment B. Much of it, however, is likely to be in the thrust washers C C of the steering column and D of the segment shaft. Frequently ball bearings are used at C C. In time either these or plain washers need replacement, likewise the bushings E E. If the steering gear case is not provided with a grease cup, this is an excellent time to put one in. Wear on the worm and segment A B is not easy to take up, an approximate cure is to make the bushings E eccentric so that by turning them the centers of the worm and segment are brought closer together. Since, however, most of the wear is in the middle teeth the gear may be loose in the middle position and tight when the wheels are cramped over. There is no remedy for this, save renewal.

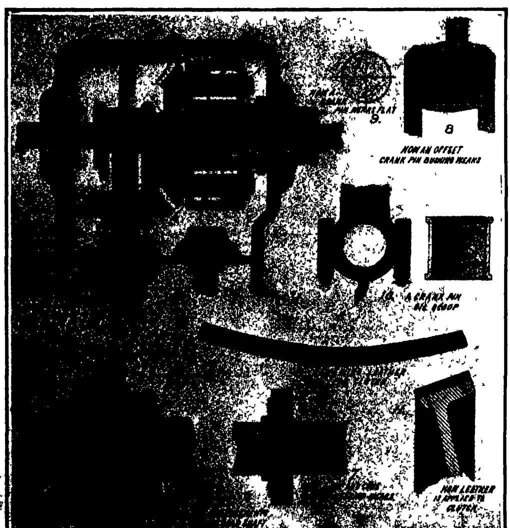
The steering knuckle pivots and the pins in the ends of the cross link wear loose in time, and usually it is a shop job to ream the holes and fit new casehardened pins. See that the front wheels are parallel or "toe in" very slightly when pointing ahead. It is usual to shape the steering knuckles so that the wheels incline toward each other at the ground. They are rarely vertical, and never incline the other way. If the front axle is sprung have a blacksmith straighten it.

Clean out gear case and test all the bushings including the pilot bushing at the front end of the squared shaft, by shaking them. If ball or roller bearings are used, replace them if loose, if plain bushings they must be refitted or replaced. New bushings bought from stock generally need considerable fitting. The rea-

(Continued on page 68.)



SOME PARTS OF A CAR WHICH MUST BE CAREFULLY CONSIDERED IN OVERHAULING.



HOW PARTS WEAR IN AN AUTOMOBILE.

AUTOMOBILE FIRE ENGINES.

A NEW TYPE OF MOTOR VEHICLE.

BY HERBERT T. WADE.

The great success of automobile fire apparatus in Europe and in many of the smaller cities of the United States frequently gives rise to the inquiry, why are such machines not used more extensively in the larger fire departments where the highest efficiency of apparatus and personnel is demanded and maintained? The acknowledged utility of automobiles for pleasure and business even under extraordinary conditions emphasizes this tardiness the more forcibly, particularly as the modern motor vehicle is now capable not only of attaining high speed but of carrying heavy loads. Promptness in reaching a fire with suitable apparatus is of prime importance, and the automobile in this respect and in endurance is easily superior to a horse. To-day with high speeds pumping capacity can be secured in a motor vehicle sufficient for most conditions of service, and this, with economy of maintenance after the initial cost, has led to the adoption of automobile fire apparatus by many of the progressive smaller cities. This economy is obviously due to the fact that only when in operation are gasoline and oil required. A horse even when idle entails expense for shoeing and feeding.

Even the most conservative of metropolitan fire officials realize that the rapid transportation by horses and the subsequent operation at high pressure of a heavy steam pumping engine on wheels is more or less a mechanical anachronism in these days, when central power stations have largely taken the place of the small isolated plant, and when small internal combustion motors using gasoline have been found economical, convenient, and efficient. The pumping power of a fire engine depends upon the weight that can be transported. As an internal-combustion motor connected with a pump would weigh much less than a steam engine and boiler and going to a fire would use the same engine for propulsion, it would follow that greater efficiency could be secured. Even superior from the mechanical standpoint, but not as yet practically applied, would be the mounting of an electric pump on a gasoline-driven motor car, using current derived from supply mains near the scene of operation. Chief Binns of the New York Fire Department has developed such an idea which possesses many obvious merits. He proposes to use electrically-driven centrifugal pumps on motor vehicles capable of high speed and to obtain power from electric light standards or other outlets which are at almost every street corner and quite as well distributed as hydrants. The same condition also prevails in many rural districts, where electric light and trolley lines are to be found on every main street. Suitable plugs and conductors could be used for connections, and with the power derived from a central station the portable machinery would be reduced to a minimum weight. A similar idea, though not so elaborately developed, was put into operation more than twenty years ago by Dr. S. S. Wheeler, now president of the Crocker-Wheeler Company, Ampere, N. J. This apparatus consisted of a bipolar motor directly coupled to a pump, and was mounted on a light carriage. The gasoline motor car was not so highly developed at this time, for which reason the carriage was drawn by horses. A fire engine built on this plan was tried out on the Erie Canal at Schenectady. It was finally brought to Ampere, and was destroyed in a fire which occurred there in 1895. Strange to say, this scheme, which would involve comparatively little outlay for a large city, has never been thoroughly and practically tested.

At present, motor apparatus is most widely used in suburbs and small cities with wooden dwellings, in other words, in communities where its high speed renders it possible to cover a much greater territory by a single company, and where infrequent alarms reduce the expense of maintenance far below that entailed for feeding and shoeing horses. For example, a St. Louis motor company recently made a run of nine miles to a country villa outside the city limits and arrived in time to save the house. This same company in a period of eighteen months responded to 1,000 fires without a single failure, and in so doing traveled 2,250 miles in all conditions of weather, including mud, sleet and snow. The economy of this company is apparent from the fact that its maintenance account for twelve months was $481.31, including two accidents, which resulted in an expense of $250, as compared with an annual cost of $816, for feeding and shoeing two horses. Even in a district where there are no water supply hydrants, such a machine can make a speedy run, and draw water from a well, canal, or pond.

MOTOR-DRIVEN CHEMICAL ENGINE.

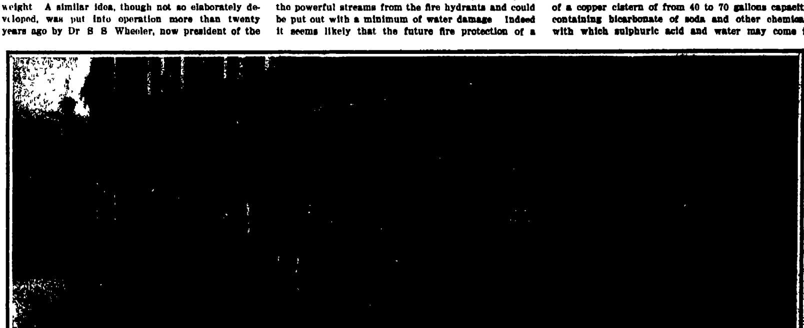
In a large city the question of territory is not as important as that of speed in getting the firemen to the fire. In a district with high pressure fire protection fires occur which taken in time may not require the powerful streams from the fire hydrants and could be put out with a minimum of water damage. Indeed it seems likely that the future fire protection of a large city will consist simply of an efficient high-pressure water system and automobile engines and hose wagons.

In a description of modern automobile fire apparatus we may mention, first, the high-speed touring car or runabout, for the use of chiefs and supervising officials, capable of rapid travel and of covering wide sections of territory. This was the first automobile used by fire departments. Such a car does not usually carry extinguishers or any fire apparatus, one or [illegible] extinguishers and axes or other tools be[illegible] only in rare instances. All that is demanded [illegible] a machine is a high quality and reliable mo[illegible] of sufficient speed and easy control. In ha[illegible] than thirty minutes Chief Croker of the [illegible] fire department is at the scene of any fire i[illegible] New York, directing in person the operatio[illegible] the firemen. This is significant in view of the large amount of territory comprising the greater city and the dangers involved in some of the outlying districts.

A modification of the chief's car may be seen in that supplied to the battalion chief or the head of the fire department of the smaller city. Extinguishers and tools are often considered essential. The chief carries with him not only a chauffeur but one or two firemen from the permanent headquarters force.

If rapid travel is desirable for the chief, it is of course equally advantageous for the firemen responding to an alarm. In small blazes such as those caused by a curtain blowing against an open gas light or by a short-circuit of a lighting system, one or two men with axes and hooks promptly on the scene can prevent what might be a serious fire in a dwelling house or stable. Accordingly it was early realized that auxiliary or emergency squads could be equipped with motor cars and could be dispatched at high speed to the scene of the fire. These men deal with an incipient fire or prepare for the steam engines which follow and if necessary send in additional alarms or communicate by telephone with headquarters. This type of equipment is extensively used throughout the United States.

But it must be realized that this means simply the prompt bringing to the scene of action the trained men who can take care of the smallest kind of a fire. Without apparatus or sufficient power nothing can be done where the blaze is at all serious. It was with this end in view that automobile fire-fighting facilities were increased by adding a chemical tank and a few hundred feet of small hose. The chemical tank and equipment has now become an indispensable feature of many fire departments. Carried on horse-drawn hose wagon, a small fire can be quenched in its incipiency by its means with a minimum use of water and consequent damage. The chemical tank consists of a copper cistern of from 40 to 70 gallons capacity containing bicarbonate of soda and other chemicals with which sulphuric acid and water may come in



A HOOK AND LADDER AUTOMOBILE TRUCK.

contact to generate carbonic-acid gas at such pressure as to be forced with the water through a small hose. This apparatus has been used with considerable success in some fire departments, but it is fair to say has been ignored or found unavailable in others. Especially is this true of New York city, where the practice has always been to concentrate at a fire adequate pumping power at the earliest possible moment and to use large quantities of water, the idea being to take no chances and even at the risk of water damage to err on the side of safety.

In the horse-drawn combination wagon the chemical tank and the small hose usually carried upon the driver's seat is but an incidental feature, the body of the wagon being reserved for larger fire-engine hose. But in a properly designed automobile such apparatus can be sped to the scene of a fire with four to eight men at from 40 to 60 miles an hour. Thus for a fire in a small suburban dwelling, in the majority of cases, a chemical engine brought close to the house with its 200 feet of ¾-inch hose, is able to extinguish an incipient fire. Such motor cars are built with engines from 24 to 50 horse-power. Because of the peculiar service conditions they are usually of the air-cooled type to obviate danger of freezing in winter. The tanks vary in capacity. It is considered good practice to install two tanks, so that one can be refilled while the other is in use. It would seem desirable that such chemical engines be supplied in the majority of fire departments to answer at once on the first alarm.

The next step in the progress of the small motor chemical engine was to make it larger and to add to its equipment. Accordingly combination engines were designed which not only carried the chemical equipment but also hose for the following steam engine, scaling ladders, tools and other apparatus, thus enabling the men to prepare the way for more serious operations and saving valuable time. In this field a number of very efficient types have been evolved.

Next in mechanical development comes the motor

(Continued on page 69.)

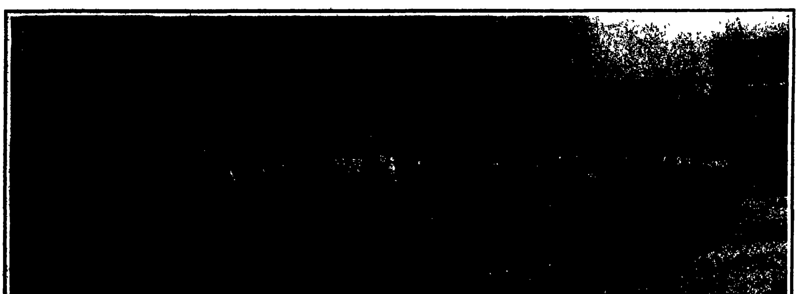
A NEW YORK AUTOMOBILE HIGH-PRESSURE SERVICE WAGON.

AN AUTOMOBILE HOSE CART

FIRE CHIEF'S AUTOMOBILE

A COMBINATION TRUCK FOR SMALL COMMUNITIES.

MOTOR-FIRE PUMP AT WORK



A COMPLETE AUTOMOBILE FIRE DEPARTMENT.

AUTOMOBILE NOVELTIES.

SOME INTERESTING DEVICES FOR THE SEASON OF 1910.

A HEAVY TRUCK WITH FOUR WHEEL DRIVE

BY DR ALFRED GRADENWITZ

The adoption of trucks in rural districts is a difficult though very important problem of the automobile industry. Bad roads and sandy soil create a number of difficulties which can be overcome only by special construction.

One of the most important points seems to be the utilization of all four wheels for driving, thus increasing the adhesion. This is especially imperative in the case of heavy motor cars employed as tractors for load trains consisting of two or three vehicles, where a weight of several tons acting on the fore axle can be utilized for adhesion.

The Daimler Motor Works of Germany have constructed for a well known Berlin export firm a heavy truck with four wheel drive which is being shipped to South Africa in order there to take up its heavy duties in propelling as tractor a train of 10 to 15 tons. This car shows a number of technical features of interest.

The chassis is made of compressed sheet steel girders with compressed transverse beams and lateral shields. The six-cylinder explosion motor located in a three-point suspension yields 60 horse-power at the brake with 900 R. P. M. This motor is of the familiar Daimler type with magneto-electric ignition.

The maximum speed of the car is 10 miles per hour. The low minimum speed, ¼ mile an hour, is remarkable, thus fully utilizing the advantage of four-wheel drive for the overcoming of gradients and traveling over sandy soil without increasing the dimensions of the gear case. As only the fore wheels are steerable, the rear wheels are driven through a toothed wheel drive.

The cast steel wheels have broad rim flanges which are intended to prevent the vehicle from penetrating too deeply into the sand. The solid rubber tires are pressed immediately on the wheels. The fore wheels are steered essentially in the same manner as other cars, through worm gearing. The vehicle is equipped with four brakes operated independently of one another, viz., a gearing brake, two differential brakes, and one rear wheel brake. The motor car, which is designed for a useful load of 5 tons, is able to haul two trailers of the same capacity while negotiating gradients of about 15 per cent with this total load of 130 hundredweight at a speed of 1¼ miles an hour. With a single trailer gradients of 7 to 8 per cent can be negotiated at a speed of 5¾ miles, so that the car seems well suited for making its way with the trailers also through deep sand.

The weight of the car inclusive of its equipment is about 12 540 pounds, of which about one-half falls on the fore axle, so that about 6 270 pounds on the fore axle is utilized for adhesion.

TRACTOR TRUCK (60-HORSE-POWER 6-CYLINDER) HAULING A TRAILER.

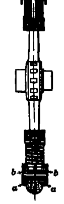
THE 60-HORSE-POWER MOTOR OF THE FOUR-WHEEL DRIVE TRUCK.

THE PARSONS SPRING MOTOR WHEEL

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

The many well known defects of the pneumatic automobile tire have prompted many inventors to attempt to evolve an efficient and reliable substitute therefor without any sacrifice of resiliency. The general trend of inventive effort has been to secure this quality by some elaborate arrangement of springs without, however, completely solving the problem.

Early in 1906, however, the Hon. R. Clere Parsons, M.A., M.Inst.C.E., directed his attention to this subject. The object of his quest was to devise a wheel which should be as resilient as the pneumatic. Although the first cost of such a wheel might be somewhat higher than the pneumatic, such a difference would be more than compensated for by the lower maintenance expenses and the longer life of the wheel. He has evolved the spring wheel illustrated in the accompanying photographs.



Longitudinal section through Parsons spring wheel.

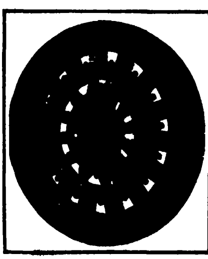
The Panflex spring wheel comprises two essential and independent parts—a double channel rim consisting of (1) an outer steel channel *aa* into which a solid rubber tire is pressed, and an inner channel *bb* formed by riveting thin rings of non-oxidizable metal on either side of the outer channel; and (2) inner radially disposed coil springs. In a driving wheel the channel rim is furnished with corrugated segments having polished surfaces riveted around the internal surface of the steel channel for the dual purpose of transmitting the driving force of the engine and the retarding force of the brake from the wheel center to the outer rim. In a non-driving wheel the corrugated segments are dispensed with, and are replaced by a smooth strip of hard bronze. This channel has no connection with the spring wheel proper.

The general design of this inner section may be comprehensively gathered from a reference to the illustration showing the wheel center complete. It comprises an ordinary wooden-spoked wheel of small diameter having a groove around its circumference, on each side of which is shrunk a steel band or tire in such a manner that a grooved space is left to receive the heads of the T bolts by which the spiral springs are secured to the rim of the wheel center. These spiral springs are of the ordinary cylindrical type, so coiled as to fit into aluminium castings at either end, and with such spaces between the coils that when compressed the steel is not overstrained. For protection against rust the springs are sherardized, and moreover each end is thoroughly tinned for a length of about half a coil.

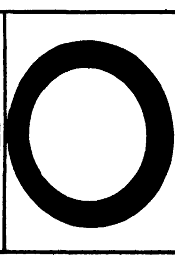
The aluminium castings by which the springs are attached to the wheel center are of special design. On one face they have a spiral tunnel or thread, so that the spring may easily screw into them, and are also provided with suitable lugs in order that they may be gripped by the T bolts. A steel tube is also cast into the aluminium base, which projects up the axis of the spring as shown in the illustration.

The aluminium castings forming the caps for attachment to the outer ends of the springs are also provided with spiral tunnels on one face into which the spring screws, while the other face has dovetailed grooves into which rubber strips of a section similar to those used for carriage tires are forced. A hole is drilled into the center of these caps, having a diameter considerably greater than that of the steel tube attached to the base, so that a space is left between the tube and the casting. The advantage of this arrangement is that in the event of the application of an excessive side force, such as sudden and violent throwing in of the clutch or braking, or the wheels being caught in a rut, the tube comes into contact with the side of the hole, thereby preventing the spring from being overstrained in any direction at right angles to its axis. In the case of high powered automobiles, the rubber strips are replaced by a solid rubber pad vulcanized to a steel plate which is attached to the aluminium cap.

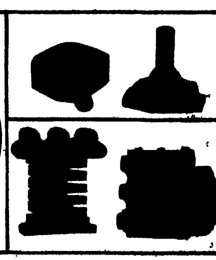
The springs are inserted into the spiral tunnels at



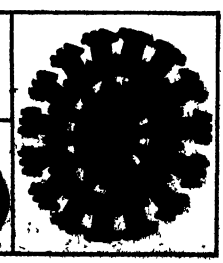
THE COMPLETE WHEEL ASSEMBLED WITH ALL ITS SPRINGS.



THE OUTER RIM AND TREAD OF THE SPRING WHEEL.



BASE MEMBERS TO WHICH SPRINGS ARE ATTACHED. SPRING, BASE, AND CAP ASSEMBLED.



THE SPRING WHEEL WITH OUTER RIM REMOVED.

their respective ends, and after correct adjustment are heated to a certain temperature, insufficient to injure their temper, and melted solder is then run in which unites with the tinning on the spring and securely combines the base and spring together in such a manner as to preclude any possibility of their becoming loosened

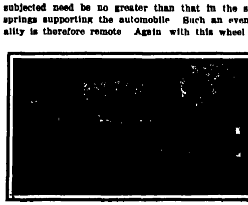
The lower springs, i. e., those just above the point of the wheel's tread, are compressed under the weight of the vehicle while those at the top do not touch the circumference The spring portion is therefore practically floating, for at no part is there any rigid connection between the inner and outer parts of the wheel When the wheel is in motion the spring and caps in its lower portion take the whole of the weight of the vehicle and are brought tightly into contact with the rim but do not shift their position relatively thereto As the wheel moves forward the springs become disengaged and move round like the spokes of a rigid wheel their places immediately being taken by others The disengaged springs travel forward relatively to the rim in the direction in which the vehicle is moving. The result is that the central portion of the wheel makes a slightly greater number of revolutions than the outer rim in a given distance At the same time however it is impossible for the inner part to travel round independently of the outer rim or tread of the wheel since it is always tightly in contact therewith at the point of the wheel's contact with the ground which is the point of application of the vehicle s weight the rubber strips of the outer extremities of the springs establishing such adhesion upon the surface of the interior of the rim as to prevent any possibility of slipping Yet there is no perceptible wear and tear upon the two contact surfaces In the case of the driving wheel the gripping power of the spring members is very considerably augmented by having the corrugated surface as already described

The successive compression of the springs as the wheel revolves is quite continuous and is effected with the utmost smoothness as the spiral springs with their caps can be deflected in every direction Sudden jerks or concussions cannot occur which even with pneumatic tires are unpleasant features when traveling at high speed over a bad road surface

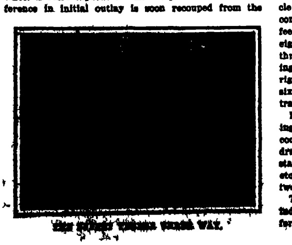
It may be thought that the absence of rigid connection between the inner and outer parts of the wheel may be disadvantageous but experience has quite conclusively demonstrated that no such draw back exists It is practically impossible for any slipping between the two parts to occur even when the vehicle is badly driven There is no friction between the rubbers in the free ends of the springs and the internal surface of the channel rim The springs as it were walk round the inner circumference of the outer rim on a polished metallic surface and are successively loaded with their due proportion of the car weight during each revolution The moment the weight is applied to any spring the latter cannot possibly move relatively to the rim until the weight is released Consequently there is an entire absence of friction and the rubber shoes in the spring caps will last as long as the wheel tire Even in the rare event of the rubbers of the spring end becoming damaged it is an insignificant item in renewal but no such occurrence has yet been experienced though wheels have been driven for thousands of miles Even the entrance of dust or mud has no deteriorating effect upon the two surfaces

The wheel has been severely tested upon a 28 36 horse power Daimler motor in comparison with the heaviest make of English pneumatic tire True the "Panflex wheel is somewhat heavier than the pneumatic but it has been found that such is no disadvantage the mileage possible per gallon of fuel under the selfsame conditions being approximately the same Trials have shown that the average life of the outer solid rubber tire is from 10 000 to 12 000 miles which is about two and a half times that of the ordinary pneumatic type Though in first cost the Panflex" wheel is more expensive than the pneumatic this difference in initial outlay is soon recouped from the reduced running expenses It has been found that the cost per mile with the pneumatic averages about 1 98 cents as compared with 0 48 cent for the spring wheel—a difference in the latter s favor of 1 50 cents Moreover as the wheel itself is practically everlasting the renewal charges are limited to the solid rubber tire which costs much less than a pneumatic of the same dimensions and the rubber caps of the spring members Occasionally as the result of a very severe concussion or jolt a spring might break This can be easily and quickly replaced on the road but as the deflection of the spring is limited in every direction by the central tube the stress to which the steel is subjected need be no greater than that in the side springs supporting the automobile Such an eventuality is therefore remote Again with this wheel in view of the ingenuity of its construction the ever existing danger of side slipping is reduced to a negligible quantity owing to the flexibility of the wheel

A FAN DYNAMOMETER FOR TESTING MOTORS



LAMBERT AUTOMOBILE RAILWAY CAR BUILT FOR HARRIMAN BRANCH ROADS



[illegible] WAY.

AN AUTOMOBILE CAR FOR RAILWAYS

The accompanying illustration shows a special car ordered by E H Harriman before his death which is to be used on a private road running from a point on the Erie Railroad to the Harriman private residence

The car is a Lambert friction drive and was ordered for the purpose of ascertaining whether a gasoline car for from 12 to 15 passengers could be utilized more economically than steam cars on branch roads on the Harriman lines Whether a car of this character will come into general use will depend upon the result of experiments to be made

AN AUTOMOBILE BUFFET TENDER

A novel automobile tender has been devised by Mr G L Reeves Mounted in the body across the rear end is a three-burner gasoline stove connected with a *one gallon gasoline tank* Next forward is a receptacle in which is fitted a complete cooking outfit each article nesting and telescoping into the other The outfit consists of two frying pans four boiling vessels coffee pot twenty serving plates three sauce pans and eight soup tins To the left of the cooking outfit is a three-bin vegetable cellar with tray lid for large cooking spoons cake turners carving forks etc To the right is a galvanized iron lined refrigerator containing six one-pint glass sealers ice receptacle and large meat tray

Immediately forward of the refrigerator and extending to the end of the bed is a seven gallon water cooler To the left of the water cooler is a thirteen drawer cabinet intended for all grocery and cooking staples knives forks spoons tea towels, table covers, etc. In the little open court there is just room for two telescoping dish pans to disappear

The accompanying picture showing the kitchen open indicates that the two covering lids when opened out form two spacious serving tables These lids are covered on the inside with padded oilcloth, and on the outside with rainproof ducking The meeting edge of one cover is provided with a patent leather flap and is held in place in transit by two large straps which buckle securely and make the tender rain and dust proof A small brass hasp and lock is also furnished A neat little folding dining table is strapped to the inside of one of these lids

An extra broiler a cooker for emergency a pocket ax and a camp lantern strapped to an outside bracket complete the outfit

The refrigerator and water cooler are fitted with drain cocks A rigid pair of folding legs is provided to support the end of the body when disconnected from the auto

The wheels have rubber tires and the several parts are so accurately nested that the tender moves even at twenty to twenty five miles speed without noise and takes corners perfectly

The tender weighs 475 pounds and the extra draft on the automobile is scarcely perceptible It has been used in serving a great many roadside dinners and its entire practicability for such service established beyond doubt

A FAN DYNAMOMETER

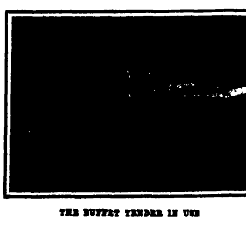
The standard type of fan dynamometer shown in the accompanying photograph has been devised by Joseph Tracy It consists essentially of a metal standard carrying a horizontal steel shaft in large ball bearings One end of this shaft is connected with the motor under test by a universally jointed extension shaft the other end carries an overhung two bladed fan as shown On the dynamometer shaft a small pulley fitted to a boss on the rear of the universal joint is belted to a larger pulley on the special tachometer which is mounted on top of the housing that carries the dynamometer shaft

The tachometer of the standard fan dynamometer is provided with a double scale and single pointer the inner scale showing the revolutions per minute and the outer scale the horse power developed The revolutions per minute scale is graduated progressively by divisions of 20 revolutions from 200 to 2 000 revolutions The horse power scale gives a minimum reading of 1 horse power at 480 revolutions and a maximum reading of 70 horse power at 1 980 revolutions Consequently at all ordinary rates of motor speed a simultaneous reading of revolutions per minute can be obtained without any computation

The standard fan dynamometer can be employed in testing motors on the block by making suitable connection between the jointed dynamometer shaft and the motor shaft clutch or flywheel It can also be used to test an automobile motor in position on the chassis by disconnecting the propeller shaft and substituting for it the jointed shaft of the dynamometer

The standard dynamometer is designed to test motors of medium sized cars However by the use of fan blades of greater or less area and suitable tachometer scales the range of absorption and measurement of power can be varied between wide limits

The Tenth National Automobile Show in Madison Square Garden afforded a good opportunity of inspecting the product of representative American makers The exhibition brought out some novelties in construction and design which showed a gratifying tendency toward standardization That the modern every day motor car generally known as a stock car has left the misty zone of experiment and is now a practical and useful machine was strongly emphasized by the many performances in hill climbing touring and racing contests of 1909 There is a comprehensive display at the Garden of duplicate models of the stock cars that competed successfully in the various sporting events of the year Some of the original cars are shown Thanks to the adoption of certain standards a new model need no longer be put through years of testing before it is entered in competition with other cars Recently victories have been won by certain makes of cars that had scarcely competed in previous events.



THE BUFFET TENDER IN USE

ANTI JOY RIDE DEVICES.

(Continued from page 49.)

made by flexible shaft connection with one of the vehicle wheels.

5. Combination mechanisms, embracing switch and engine hood lock and vibration recorder

Some of these devices are now to all intents practically obsolete and out of the market, and there never has been any general demand for any of them except those intended merely to prevent meddlesome persons and mischievous children from tampering with machines left standing at the curb The one class of device that is in almost universal use is the lock switch Almost every large manufacturer of ignition spark coils and switches offers a current switch with a removable plug or lever or fitted with a lock and key by which the connection between the battery or magneto and the engine spark plugs can be broken and prevented from being re-established readily.

The type of switches with removable plug is illustrated in Fig. 1 Switches of this type are known as plug cut-out switches and are now designed to be used with a dual system of ignition, so that either the battery or magneto can be switched into use or the current from either of two batteries turned on When the car is stopped, the metal plug, with insulated handle, which makes connection between the two terminals within the switch, as shown in the underside view, Fig 1, is withdrawn and the circuit is broken. The engine cannot then be restarted until the plug has been replaced or electrical connection has been re-established in some other way The plug is small and can be carried conveniently in the pocket.

A modification of this type which precludes the possibility of inserting a nail or piece of wire as a substitute for the plug is shown in Fig 2, in which the switch lever is removable There are numerous makes of such switches. The end of the lever engages by a slot or keyway with a post that prevents it from dropping off and at the same time assists in forming an electrical connection The other end of the lever, fitted with a non-conducting composition handle, can be swung in an arc or complete circle to make contact with any desired contact button for use of batteries or magneto or to neutral "off" position

A further development of the lock switch idea is seen in the auto lock plug (Fig 3) in which a Yale lock is applied to a plug cut-out switch in such a way as positively to prevent the closing of the circuit through the switch without the proper key or its duplicate. The lock is placed directly above the plug socket, thus preventing the insertion of a nail or wire The cut-out plug is connected with the mechanism of the lock so that it is thrust in or out by the turning of the key The key cannot be removed from the lock until the circuit is broken Each lock requires a different key, of which two duplicates are furnished to the purchaser

The Yale lock, with sliding plug connection to take the place of the regular cut-out plug, can be fitted to various styles and makes of switches, being held on by screws of a special kind that cannot be removed except with a double-pointed wrench made just to fit the recess in the screw heads.

A device of somewhat similar characteristics to the foregoing is the break-circuit autolock (Fig 4), which is manufactured in different forms for use on electric and gasoline vehicles. The type illustrated is for electric machines, but the operation of the two styles is similar When the switch bar, just above the barrel of the Yale lock, is pulled forward it breaks the circuit and remains locked in this position until one of the two keys furnished with the device is inserted and given a half turn, when the connection is re-established automatically by the switch bar springing back into place The electric vehicle lock is installed beneath the upholstering on the arm of the seat, where only the face of the lock is exposed. It takes the place of the ordinary cut-out plug, so that the operation of the lock is no additional bother

The break-circuit lock for gasoline vehicles (Fig 5) is made in different styles to apply to various systems of ignition. It is placed on the face of the coil box, taking the place of the usual switch The switch-bar is round and provided with a winged head, so that it can be rotated to make connection with battery or magneto or to "off" position at will. When it is pulled forward it breaks the circuit completely It is not necessary, however, to turn the bar or plug to neutral before locking or unlocking the switch.

Another means of accomplishing the purpose of preventing meddlesome persons from using a car left standing in the street or garage is the Rochester steering wheel lock (Fig 6) This is hinged so that the hasp can be placed around the steering column. A steel pin at the back of the hasp enters a quarter-inch hole drilled through the outer and inner steering columns. When the hole in the inner column, to the top of which is keyed the steering hand wheel, has been brought opposite that in the outer post and the pin of the lock has been inserted through both, the front wheels cannot be turned.

The special feature of this device is the combination lock that renders unnecessary the use of a key, which may be mislaid, forgotten or lost. The barrel of the lock contains three tumblers each provided with a small lug on either side which engages with the corresponding lug on the next tumbler Two tumblers are fastened to an internal top cap but are free to rotate on its center pin, while the third tumbler is removable and lies in the body or casing of the lock over a solid post that passes through its center All the tumblers have a large notch in the periphery To open the lock it is necessary to turn the external dial hand until all of the notches in the tumblers are brought into line, allowing the catch of the hasp to pass. This can be done only by working the lock combination.

The lock can be operated in the dark, as the dial is notched so that by starting at 0—which is distinguished by a large or open notch—the movement of the hand over the dial can be counted as the spring points drop successively into the serrations. When the lock is open, the combination can be changed in two minutes if desired Except for the steel pin, this lock is made entirely of bronze and is made in different sizes to fit steering columns of different diameters. The manufacturers have also produced an adjustable hasp steering column lock made with four-tumbler combination and operated by a key

In division *B* of group 2 is a new invention brought out this season under the name Bongartz autolock (Fig 8) The device is designed as a lock to prevent use of the gear shift lever and, if desired, also of the brake lever It consists of a simple lock incased in a polished heavy brass case to be attached to the side of the car or the footboard directly behind the lever quadrant, and a rod with a head on one end and a recess in the other end to be engaged by the plunger of the lock With the gear-shift lever in neutral or in operative position, a hole of suitable size is drilled through the quadrant and shank of the lever to receive the rod The lock case is then secured to the body or frame in such position that the hole for the end of the rod will be in alignment with the hole drilled through the quadrant Now, when the car is stopped and the gears unmeshed, the rod can be inserted and engaged in the lock, when it will be impossible for anyone not possessing the key to start the machine.

A notable advantage possessed by this device is that, while preventing the car from being driven on the road, it does not interfere in any way with its movement by hand in the garage or with the adjusting and "tuning up" of the engine and its attachments by the chauffeur or workmen.

Not only is it essential that the unauthorized use of motor cars should be prevented but it is almost equally desirable that some measure be taken to curb the speed enthusiasm of the hired chauffeur even when the owner is occupying the tonneau or interior of the limousine or landaulet It is not altogether improbable that the owner needs a check on himself, as in the exhilaration of a good road, bracing atmosphere, and smoothly running car he may unwittingly let enthusiasm overstep discretion Numerous efforts have been made to produce something that would accomplish such results by the sounding of audible signals when the car had attained to a certain speed or by the display of a prominent speed indicating device that could be read at a distance by every passer-by The objections to these devices, however, were so obvious that they never met with favor except on the part of persons afflicted with motorphobia and lawmakers eager for popularity among their constituents.

A practical device intended to accomplish the same results in a much better and more effective way has been brought out recently for use in combination with a well known make of speedometer This is the Jones automatic speed-control governor (Fig 9) The mechanism consists essentially of a speed indicator, an automatic circuit breaker, a controller switch, and an electrically operated air valve, not indicated. The electric switch, which has five or more points of contact representing circuits, is operated by the action of the centrifugal governor of the speed indicator The switch is so arranged that when the indicating hand of the speedometer shows a speed of ten miles an hour the switch will close the circuit through the first contact, when the velocity of the governor is such as to indicate fifteen miles an hour on the dial, the switch closes a circuit through the second contact, and so on up to any desired number of speeds or contacts.

By setting the pointer at any figure on the dial of the controller switch, the circuit can be made to close through the corresponding contact only and at the indicated speed When this circuit is closed, it actuates the current to the primary of the induction or spark coil, thereby cutting off the spark from the engine Or it may be arranged to operate the electrically controlled air valve or throttle, shutting off the supply of air or gas to the engine and thereby preventing the speed of the car from exceeding the indicated limit. As soon as the speed is reduced, the contact automatically cuts out and the engine gets its power again. Should the pointer of the controlling switch be set at an intermediate position, as in the illustration, the device will have no action whatever on the speed of the car.

As the controlling switch can be located almost anywhere in the car, it is evident that the owner or any occupant of the rear seat can limit the speed as desired, regardless of the driver. The device operates silently and is always on guard, giving a sense of security in passing through sections where the speed regulations are rigidly enforced.

An example of the vehicle movement indicating instruments classified under *A*, group 4, is the watch-dog vibration register (Fig. 10). This operates on the principle of the pedometer, a pendulum or weighted arm being held normally in a horizontal position by a light spring and caused to beat by reason of the momentum of the weight following every downward and upward movement of the instrument. Each beat of the pendulum releases a tooth in the train of gears which actuate the indicator hand and register figures on the dial The dial is 2½ inches in diameter and is divided into 100 degrees. These divisions do not represent either hours or miles, but serve as a measure of the vibrations. Different cars oscillate vertically in different periods, it has been found, but each machine oscillates very nearly the same number of times for successive miles irrespective of its speed. Engine vibrations when the car is standing still do not affect the instrument, therefore the device makes no record except when the vehicle is in motion.

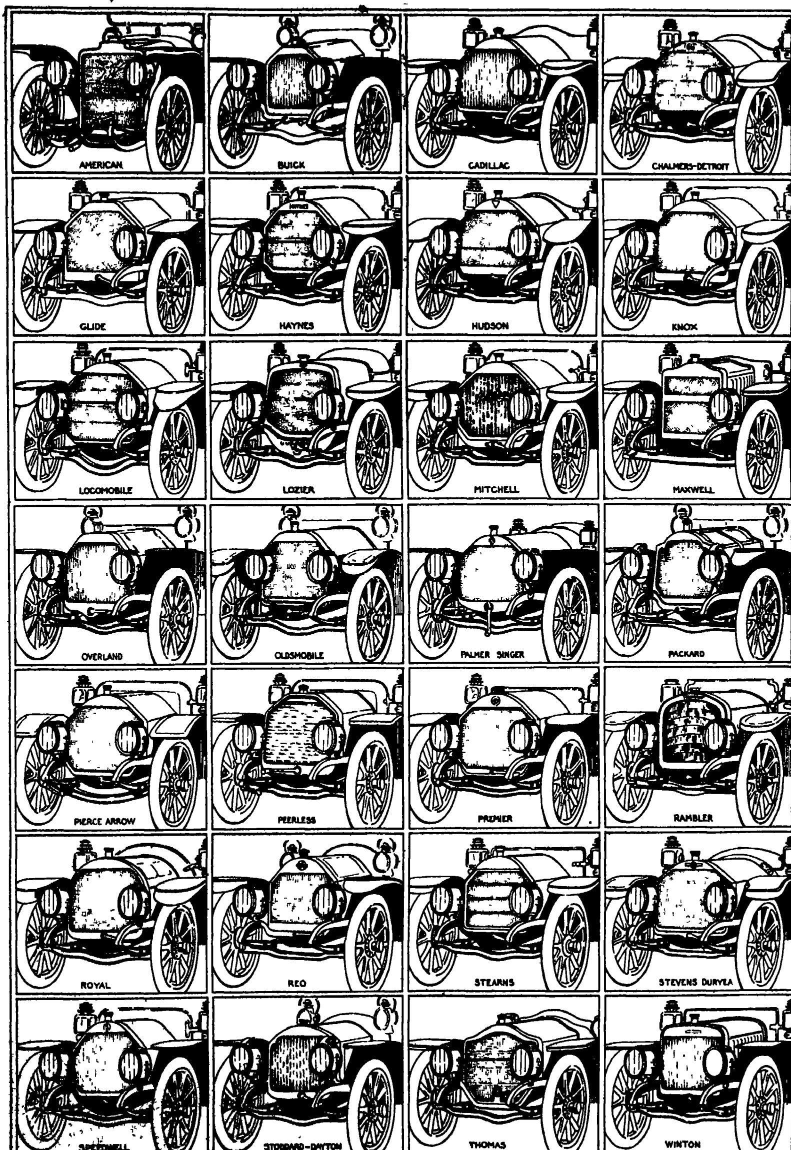
The instrument is intended to be attached permanently to the car so that it cannot be removed without the owner's knowledge and is securely sealed so that no one can tamper with the register There is no shaft or wires connecting it with any working part of the automobile whose detachment or disconnection would render the recorder inoperative. The owner, having by observation determined that on his machine the instrument indicates say 10 points for each hour of travel, will have no difficulty in determining from the reading of the dial how many hours his machine has been driven after he last had it out.

A different type of vehicle movement indicator is represented by the Bullard recorder (Fig. 7) This provides a permanent record on paper of the hours during which the vehicle was used, the rate at which it was run during every mile traveled and the number and duration of stops made. It operates by a combination of clockwork movement and flexible shaft drive from one of the road wheels. The clock mechanism rotates a circular paper dial that makes one complete revolution every hour in the same direction as the hands of a clock The dial is divided into sixty radial spaces representing minutes, every fifth line being heavier than the intermediate lines for convenience in reading From center to circumference there are twelve circular divisions, also corresponding to the hours. Within the instrument is a stylus operated by both the clock and movement of the car, which makes a perforation in the paper dial for each quarter mile traveled, every fourth perforation being deeper than the others to indicate the completed mile The stylus is at the extreme outside space when the instrument is set for a record and moves toward the center at the rate of one space each hour, being moved by the clock and requiring twelve hours to move across the dial, where it becomes inoperative until reset.

So long as the car stands idle the dial rotates without being punctured by the stylus, but for every quarter mile the car travels (if a pleasure vehicle) one perforation is made And according as the machine is driven fast or slow the holes are close together or farther part. At the rate of a mile in four minutes, or fifteen miles an hour, there will be just one hole for each radial division, while at sixty miles an hour there would be four By examination of the dial it is possible to determine the exact hour and minute at which the car was started and stopped. Combined with the instrument is a tiny odometer which registers the total mileage up to 10,000, The instrument depends for operation on a simple train of gears and ordinary clockwork and the same connection with the road wheels as every speed indicator The inventor decided upon the perforating system because it cannot be tampered with without detection, no jar or jolt of the car can derange it and cold weather or dry cannot render it inoperative. For use on commercial vehicles, which move at a slower rate of speed, the stylus is made to perforate for every eighth mile instead of every quarter,

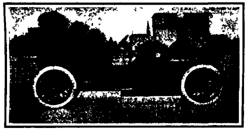
Much the most comprehensive invention to prevent the unauthorized use of motor cars that has been made is that of Leon Ottinger of New York city (Fig. 11). It is called the [illegible] recording lock, this trade name being adopted because of the combination of functions it performs, which also brings it into group 5 of our classification. By a single operation it locks both the ignition switch and the hood over the engine compartment, so that it is impossible to raise the hood without the use of the Yale key that fits the lock. Provision can also be made if desired for locking

(Continued on page [illegible].)



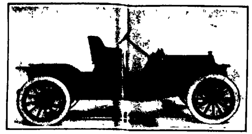
Often you have wondered what make of car was that which sped past your eyes or around a curve. Although most automobiles are more or less alike in general appearance, they differ in certain features. The radiator and engine bonnet are among these. With the help of this chart, the cars here presented can be identified by their radiators and engine bonnets.

AN AUTOMOBILE IDENTIFICATION CHART.



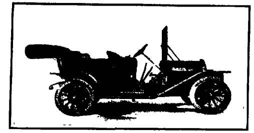
Chalmers-Detroit 40 horse-power pony tonneau.
Cone clutch, four cylinders cast in pairs, bore 5 inches by 4½ inches stroke, water cooling, with honeycomb radiator, jump spark ignition, shaft drive, selective sliding gear transmission. Price $1,750.

Cartercar, 35 horse-power.
Motor, bore 4¼ inches by 4½ inches stroke, four cylinders cast in pairs, low tension ignition, friction transmission, non-floating rear axle, chain in-oil drive, one-lever control. Price $1,600.



Schacht convertible car.
Motor, opposed water cooled, 5¼ inches bore by 4½ inches stroke, planetary transmission, chain drive, jump spark ignition; internal expanding brakes on rear wheels. Price, $975.

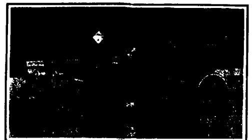
Brush runabout
10 horse-power motor, balanced single cylinder, 4 cycle, vertical, 4 inches bore by 5 inches stroke, three point suspension, internal gear transmission, bevel gear drive, single hand lever control, internal expanding brakes on rear sprocket hubs. Price $485.



Overland touring car, 35-40 horse-power
Cone clutch, contracting and expanding brakes, four cylinders cast separately, bore 4¼ inches by 4½ inches stroke, water cooled, with flat vertical tube radiator, shaft drive, selective sliding gear transmission. Price $1,250.

Franklin 12-horse-power touring car
Multiple disk clutch, 6 cylinders cast separately, bore 4¼ inches by 4 inches stroke, air cooled, jump spark ignition, shaft drive, selective sliding gear transmission. Price $1,750.

Hupmobile runabout.
Horse-power 20, cylinders 4 arranged in pairs, bore, 3¼ inches; stroke, 3⅜ inches, water cooled, ignition high tension Bosch magneto, shaft drive; 1 universal joint, selective gear transmission, two foot and two emergency brakes. Price $750.

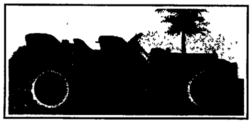


Premier 40-horse-power touring car
Four cylinders cast in pairs; bore, 4½ inches by 5¼ inches stroke, water cooled with cellular radiator, make-and-break ignition; shaft drive, selective sliding gear transmission. Price, $3,500.

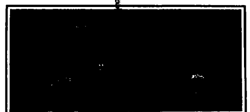
Rambler touring car
Motor, bore 5 inches, stroke 5½ inches, 4 cylinders, ignition high tension, transmission 3 speeds selective, horse-power, 45, brakes on hubs. Price $2,500.

Oldsmobile 40-horse-power special touring car
Four cylinders, bore 4¾ inches, stroke 4¾ inches, water cooled, jump spark ignition, high tension magneto and dry battery, shaft drive, selective sliding gear transmission. Price $3,000.

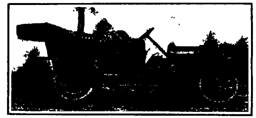
Winton touring car
Horse-power (A. L. A. M. rating) 48.6, 6 cylinders, bore 4½ inches, stroke 5 inches, water cooled, jump spark ignition, high tension magneto and storage battery, shaft drive, selective sliding gear transmission. Price $3,000.



Pierce Arrow touring car.
Horse-power (A. L. A. M. rating) 48, 6 cylinders, bore 4½ inches, stroke 4¾ inches, water cooled, ignition jump spark, shaft drive, selective sliding gear transmission. Price, $5,000.

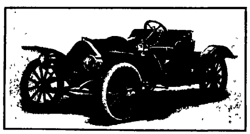


Cadillac 30-horse-power limousine.
Cone clutch, contracting and expanding brakes on rear wheels, 4 cylinders cast separately; bore 4½ inches by stroke 4½ inches, water cooled with tubular radiator, jump spark ignition, shaft drive, selective sliding gear transmission. Price, $3,000.



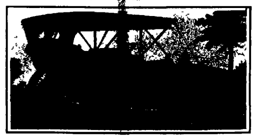
Pope Hartford 40-horse-power touring car
Four cylinders, bore 4⅛ inches, stroke 5½ inches, water cooled, jump spark ignition, expanding brake on propeller shaft and both rear wheels, shaft drive, selective sliding gear transmission. Price $2,750.

Baker electric runabout
Bevel gear shaft drive, semi-floating rear axle with ball bearings, motor four pole series wound, controller continuous torque drum type with 6 speeds forward and 3 reverse, 4 brakes, 2 internal and 2 emergency. Price $2,000.

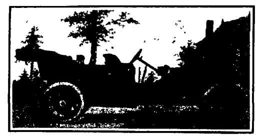


The K-R-I-T runabout
Wheel base 90 inches, wheels 32 inches, sliding gear transmission, horse-power 22½, multiple disk clutch, weight 1,200 pounds. Price $800.

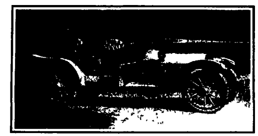
Maxwell 40-horse-power touring car
Four cylinders, bore 4½ inches, stroke 4¾ inches, water cooled, jump spark ignition, low tension magneto and dry battery, shaft drive, progressive sliding gear transmission. Price, $1,575.



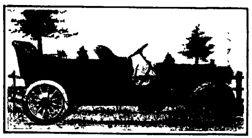
Royal Tourist touring car.
Horse-power (A. L. A. M. rating), 48, cylinders, 4, bore, 5½ inches, stroke, 6 inches, water cooled, jump spark ignition, shaft drive, transmission, selective sliding gear, expanding brakes. Price, $4,500.



Mitchell touring car
Horse-power (A. L. A. M. rating) 48.6, 6 cylinders, bore 4½ inches, stroke, 5 inches, water cooled, jump spark ignition, high tension magneto and dry battery, shaft drive, transmission selective sliding gear. Price, $2,000.

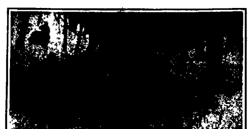


Stevens Duryea touring car
Horse-power (A. L. A. M. rating) 38.4, 6 cylinders, bore 4¼ inches, stroke 4¼ inches, water cooled, jump spark ignition, high tension magneto and dry battery, shaft drive, transmission progressive sliding gear. Price $4,000.

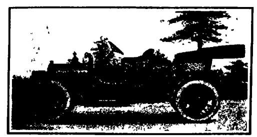


Packard 30-horse-power touring car
Four cylinders, bore 5 inches, stroke 5½ inches, water cooled; jump spark ignition, low tension magneto and storage battery, shaft drive, progressive sliding gear transmission. Price, $4,200.

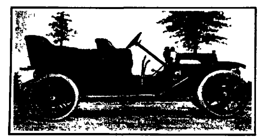
Peerless 30-horse-power touring car.
Four cylinders cast in pairs, bore, 4⅝ inches, stroke, 5½ inches; water cooled, with tubular radiator, jump spark ignition, with high tension ignition and storage battery; selective sliding gear transmission. Price, $4,475.



The Hudson runabout.
Cone clutch, horse-power 22.5, four cylinders cast en bloc, bore, 3¾ inches by 4½ inches stroke, water cooled, jump spark ignition, selective sliding gear transmission, contracting brake on propeller shaft and expanding on both rear wheels. Price, $900.



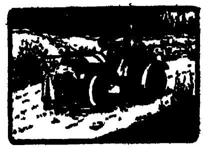
White 20-horse-power gasoline car.
Cone clutch; 4 cylinders cast en bloc, bore, 3¾ inches; stroke, 5⅛ inches, water cooled, jump spark ignition with high tension magneto, shaft drive, selective sliding gear transmission. Price, $2,000.



Everitt-Metzger-Flanders 30-horse-power touring car
Wheel base, 108 inches, four cylinders cast in pairs, bore 4 inches, stroke 4½ inches, water cooled, jump spark ignition, selective sliding gear transmission. Price, $1,250.

THE CARS OF 191 —BIG AND LITTLE.

MAKING YOUR OWN REPAIRS.



BY ROGER B. WHITMAN.

To one who is familiar with the methods employed in the average automobile repair shop it is not surprising that owners of cars complain of the size of their bills The principal charge is usually for labor at so much an hour but there is no way in which the owner can assure himself that part of the time charged for was not wasted The difficulty of checking a labor charge is an inducement to a mild form of swindling and it must be admitted that there are shops in which an hour's work by an untrained boy is charged for at the rate for skilled labor Then again time may be wasted unintentionally It is not unusual to find that after assembling an engine or a gearset the work must be undone in order to fit an overlooked part or to correct an adjustment that should have been attended to in the first place and in such an event the total time occupied is usually charged to the owner of the car

When the prospective purchaser of an automobile is of a properly inquiring turn of mind he will ask his friends to let him see their bills for repairs and maintenance and will probably gain the impression that automobiling is an expensive diversion If he has any mechanical ability however he will realize that three-quarters of the work charged for could have been done with simple tools and an ordinary knowledge of their use

Aside from the economy of it the owner who does his own work becomes so familiar with the mechanism that it is instinctive with him to recognize the signs of coming trouble He corrects faults at their inception and by so doing he obviates an otherwise inevitable delay and expense

The following notes are offered as suggestions to the owner who desires to render himself independent of the repair shop

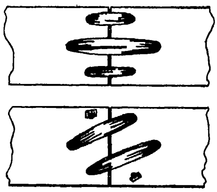
VALVE GRINDING

At more or less frequent intervals the valves of a gasoline engine and particularly the exhaust valves will become roughened and pitted When they are in this condition they cannot be expected to retain the compressed gases and in consequence the engine cannot deliver its full power It then becomes necessary to grind in the valves which is accomplished by introducing an abrasive between the valve and its seat and rotating the valve under light pressure until the surfaces are worn smooth This is usually considered to be a job for a repair man but as it is patience rather than skill that is required the car owner need not hesitate to undertake it

Before grinding can begin the valve must be relieved from the pressure of its spring In many engines the valve seat and spring are contained in a cage that is easily removed and the detaching of the spring from the stem is an easy matter When the valve seat is integral with the cylinder the spring may be compressed by means of a special tool or by a flat metal bar used as a lever To prevent the valve from moving a small block of wood may be placed between the valve disk and the valve cap When the spring is compressed the device through which it acts on the valve stem may be removed The valve may then be taken out through the valve cap opening

When a valve is in bad condition the surfaces of the disk and seat are rough and pitted It is not necessary to continue the grinding process until the entire width of the surfaces is smooth for a narrower ring or belt is sufficient to retain the gases if it is continuous and uninterrupted Finely powdered emery mixed with machine oil is a satisfactory abrasive but whatever is used great care must be taken to keep it out of the cylinder and away from the bearing surfaces The passage between the valve pocket and cylinder should be tightly plugged with cotton waste a string tied to it facilitating its removal when the work is completed

For a badly worn valve the first grinding is done with coarse emery which is later replaced by a finer grade to give the requisite smoothness To apply the abrasive dip the finger tip in machine oil and then in dry emery the small quantity that adheres being applied to the valve surface The valve is then replaced on its seat and rotated by means of a screw driver A bit brace or breast drill may be used but excellent results may be obtained by means of an 8 inch or 12 inch screwdriver with a round grooved handle which is held between the extended palms A con-



LACING A FAN BELT

tinuous rotary motion in one direction will tend to wear the valve oval and it is necessary to turn it first in one direction and then equally in the other A slight back and forth motion of the hands will give this result and as only a light pressure is necessary it should not prove tiresome

In order to preserve the true circular form of the valve and seat the valve should be lifted after twenty or thirty turns and replaced on its seat in a new position To facilitate this a few turns of a helical spring may be placed in the valve pocket under the disk its size and strength being such that the valve will be slightly lifted from its seat when pressure is taken off the screwdriver The location of the spring is shown in the diagram

When the valve surfaces appear smooth all traces of the emery should be washed away with gasoline care being taken that it does not lodge in the cylinder valve stem and push rod guides or other bearing parts To test the fit make pencil marks on the valve seat and give the valve a turn or two with the screwdriver if the fit is correct the marks will be erased

The replacing of the valve spring is greatly simplified if it is compressed in a vise and bound in the compressed state by light iron or copper wires passed through it lengthways The spring may then be placed on the valve stem and the holding device attached after which the wires are cut.

LINING UP THE WHEELS

GRINDING A VALVE.

TIMING AN IGNITER.

"TAKING DOWN" A MACHINE.

When the average man finds it necessary to take any kind of a machine to pieces he is inclined to consider results rather than methods. He unscrews all of the nuts and bolts that are to be seen, and as each comes off he lays it down wherever there is room to put it regardless of order or system. He is not likely to notice the exact position of a piece before he takes it off and in general is unobservant of the foresight that would go far to simplify the reassembling If time is not an object he will eventually get all the parts properly rebuilt but if he aspires to be a good workman he must learn to be methodical in everything that he does

The first step in dismounting any part of an automobile is to ascertain what holds it in position what other parts may have to be displaced in order to get at it and what parts may be released by its removal To take off an inlet manifold for instance it may first be necessary to remove the carbureter which in turn will require the disconnection of the gasoline pipe and throttle control.

The plan of action having been determined work may begin It will greatly facilitate reassembling if nuts bolts screws and other small parts are placed in boxes the parts belonging to the inlet pipe in one, inspection plate bolts in another and so on If these parts are laid indiscriminately on the engine and frame they are only too likely to fall into hand holes and other openings and aside from the difficulty of recovering them they must then be sorted

Where several parts are alike in shape and size—valve caps for instance—it should not be taken for granted that they are interchangeable Each may have been fitted to its particular location and on the chance of this they should be marked before being removed so that there may be no error in returning them Some manufacturers are careful to mark all parts by letter or figure or with a prick punch and when this is the case the marks should be followed absolutely In the case of gears it is usual to make three punch marks at the point of meshing To reassemble them correctly it is then necessary only to place the marked tooth of one gear between the two marked teeth of the other

When taking off a cylinder the connecting rod should be blocked or supported Otherwise the weight of the piston will bring it sharply against the crank case which may suffer in consequence If the cylinders are to remain off for any length of time they should be plugged with cotton waste at all openings and several thicknesses of paper should be tied around the pistons

In reassembling, all nuts bolts and screws should be cleaned and oiled before being replaced Every bolt has its wrench of appropriate size with which it is hardly possible to exert a breakage strain When an 18 inch wrench is used on a ¼ inch bolt there is every possibility of the bolt head being twisted off before the operator realizes that it is in danger

If the parts of a properly made machine do not come off with reasonable freeness when the bolts and nuts are removed force should be avoided until it is proven to be necessary Taper pins keys and unsuspected set screws are frequently responsible and as they must be accurately replaced their location and direction should be noted and remembered

It is poor policy to rush a piece of work and after a few experiences with compression water and gasoline leaks that could be avoided by giving more time to the job in hand the motorist will hang in his shop the motto "Go slow, go sure," and abide by it

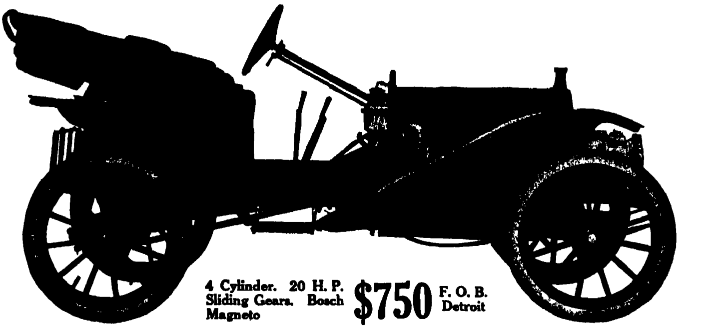
LUBRICATING THE SPRINGS

It is the practice among automobile manufacturers to fit grease cups to the shackles and eyes of the springs, and the user of a car is inclined to take it for granted that there is nothing more to do for the springs than to turn down these cups occasionally It should be noted however that the spring leaves require lubrication at least once a season There is a continual sliding motion of the leaves when the spring is in action If the surfaces are not lubricated they will be subject to undue wear and eventual breakage.

The proper lubricant is a mixture of graphite and

(Continued on page [illegible].)

COMPARES WITH THE COSTLIEST CARS AS A PERFECT SMALL DIAMOND WITH A LARGE ONE



4 Cylinder. 20 H. P. Sliding Gears. Bosch Magneto **$750** F. O. B. Detroit

Hupmobile

A small diamond is relatively just as good and just as valuable as a large one.

In the same sense the Hupmobile is precisely as fine as the largest, the best and the most expensive cars made.

We make the comparison because we want you to learn to associate the Hupmobile in your mind with the finest cars you know.

The Hupmobile claims the right (and that right is conceded by discriminating owners) to travel side by side with the best products of motordom

It confesses no delinquencies, admits no inferiorities; concedes no advantage save size and carrying capacity, to cars costing twice and thrice its price.

Observe the personnel of its ownership in your own city.

Note that the majority of men who drive a Hupmobile are the men who know good cars—whose private garage, perhaps, houses several fine cars of other types.

The Hupmobile was built to fill a particular need—to supply a special want—to furnish a type of car that was lacking.

Its creators could see no reason why a car carrying two passengers should not be just as good—just as sound and just as trustworthy—as the best big car built.

Every part that contributes to power and speed and staunchness in the Hupmobile is precisely as good and fine as the same part in the best big car.

The two are mates in quality.

The Hupmobile will go anywhere that the big car will go; climb any hill the big car will climb; and do anything the big car will do except that it will not carry the same number of passengers.

When you buy the ordinary car of moderate price, you say to yourself:—

"I am getting just the sort of a car indicated by the price—a moderately good car."

When you buy a Hupmobile, on the contrary, you buy a quality and a degree of excellence with which the price has nothing to do

If the Hupmobile were any bigger, it could not be made as good without increasing the price.

SPECIFICATIONS

ENGINE—4 cylinder, 20 H. P., 3¼ inch bore, 3½ inch stroke; L-head type; water cooled; offset crank shaft; fan bladed fly wheel in front; Parsons white bronze bearings; noiseless cam shaft.

TRANSMISSION—Selective sliding gears in extension bolted to crank case; shifting without noise.

CLUTCH—Multiple disc type; self-adjusting; enclosed in gear case; running in oil.

REAR AXLE—Shaft drive; Hyatt roller and New Departure bearings; shaft and universal joint enclosed and lubricated by oil from crank case through transmission.

BRAKES—Two foot and two emergency (internal expanding) lined with Thermoid on rear hubs.

IGNITION—Bosch high tension magneto, doing away with spark coil, batteries and connecting wires.

TIRES—30 x 3 inches.

WHEEL BASE—86 inches.

TREAD—56 inches.

SPRINGS—Semi-elliptical front, patented cross spring rear.

EQUIPMENT—Two side and tail oil lamps, dragon horn, tools, repair kit, pump.

WEIGHT—1100 pounds regular equipment.

These things (which are literally true) will explain to you what perhaps, you had not understood before—why you have encountered in the year past so many enthusiastic partisans of the Hupmobile

Everybody, if you will stop to think backward a little bit, has seemed to say kind things about the Hupmobile.

They have said these things about the Hupmobile because it is the newly good kind of a moderate sized car which we have just described

A year ago there were less than 100 Hupmobiles in commission.

Today 5,000 are being built, as rapidly as excellence of workmanship with the finest materials will permit of hurry—to satisfy a demand which sprang up in incredible volume before the first hundred cars were completed

Of course, you want to know all about a car which has been favored with the warmest approval ever extended by the American motor-buying public to any motor car

Even if you own a car to which you are strongly attached, you would like to have placed before you all the information which will shed light upon a condition so unprecedented as the Hupmobile has created

And if you are wavering in your choice of a car, your desire to know is even stronger

Sign and send the coupon

It will bring you not only the Hupmobile literature, picturing and describing the 1910 Hupmobile in every detail

It will bring in addition, the name and address of the Hupmobile dealer in your home or the one nearest you

We will put you in direct touch with the car, so that you can ride in it and satisfy yourself as to the literal truth of every statement we have made.

Clip the coupon and send it now

As an object lesson, three Hupmobiles were driven through the biting winter weather and deep snows, from Detroit to New York for the Grand Central Palace Show.

HUPP MOTOR CAR COMPANY

DEPT. Q DETROIT, MICH.

Hupp Motor Car Co.
Dept. Q
DETROIT, MICH.

Send 1910 Hupmobile literature and name and address of Hupmobile dealer

Name

Address

AUTOMOBILE NOTES.

Undoubtedly the weak points in the pneumatic tire whether it be that of a cycle or motor vehicle, are its cost of up-keep and liability to puncture It is clear that the direction in which improvements have been made is in the thickening of the tread, so as not only to render punctures less frequent, but also to give the tire a longer life, and thus save expense In some makes of tire, the increase in thickness of the tread of the outer cover, and in others that of the inner tube, has been so great that most of the resiliency has been lost, and the tire practically becomes a solid one In order to restore the resiliency, it has been proposed to reduce the air pressure in the internal tube, but this causes not only excessive internal friction between the inner tube and the cover, which is in any case difficult to avoid altogether, but also produces a large flat surface, in contact with the road, which adds considerably to the tractive resistance, especially when the surface of the road is soft The evils of traveling on slack pneumatic tires are known to all cycle riders, and are carefully avoided by keeping them inflated with a sufficient air pressure The air pressure which it is necessary to maintain in the inner tubes of the pneumatic tires of a heavy vehicle is not less than 100 pounds per square inch, and should the slightest defect occur which allows the air to escape, the tire is not only rendered useless to support the vehicle but is speedily damaged if the collapse is not quickly repaired.

At the Tenth National Automobile Show in Madison Square Garden there will be the only complete motor cycle exhibit in New York in 1910 by the Motorcycle Manufacturers' Association An inspection of the new models on display there proves that the motorcycle not only is a pleasure vehicle for poor and rich alike—ranging in price from $100 for the small single-cylinder machine to more than $500 for the expensive four cylinder touring model *de luxe*—but a utility vehicle as well General refinement seems to be the tendency for 1910 Many improvements have been made in spring forks as the result of hard road contests during the past year Some of the machines appear with spring frames and longer wheel base, all of which make for the comfort of the rider As regards the appearance of the motorcycle better quality and more lasting enamel as well as heavier plating seems to be the aim of the manufacturers. Handlebar control is practically universal, and magneto ignition will be more popular than ever, several of the makers having decided to make this type of ignition standard equipment, instead of optional as heretofore Increased power apparently is a general tendency, and mechanical oilers are also in evidence, which eliminate guesswork in lubrication, one of the bugbears of riding Several of the manufacturers have decided to abolish the muffler cut-out which, with the muffler improvement noticeable, should make the motorcycle of 1910 as silent a steed as its forerunner, the bicycle.

Two Chalmers-Detroit chassis models will be manufactured in 1910, the "Thirty" and the "Forty," both a continuation of those presented for 1909 The changes, while important, are not in any case radical The new Chalmers-Detroit 'Thirty" will have a 115-inch wheel base, three inches longer than the 1909 Forty It will have 34-inch wheels—two inches larger than last season The hood will be three inches longer and two inches higher—in keeping with the larger body The tonneau will be large and roomy The 'Thirty' motor is more powerful this year than last The 1910 'Forty has a 122 inch wheel base—ten inches longer than last season It has 36-inch wheels, and room for seven passengers. The 1909 Forty' was a five-passenger car

The Tenth National Automobile Show in Madison Square Garden eclipses any former exhibition of motor cars, motorcycles, and accessories ever held in the famous building There is a total of 323 different displays, of which there are 34 exhibits of complete cars besides 246 exhibits of accessories and parts, and 23 motorcycle exhibits Even with an increase over last year of more than 7 000 feet of exhibition space which the show managers by ingenious methods were able to eke out of the Garden interior, there is not one foot of unused space available for exhibition purposes. This situation is indeed a striking commentary on the growth of the industry when it is realized that at the first automobile show in this country, in 1900, there were only 60 exhibitors who displayed their product in the Garden

Noteworthy among the runabouts costing much less than $1,000 is the Hupmobile made by the Hupp Motor Car Company Detroit Mich In its construction the makers have endeavored to impart to their runabout all the staunchness excellent workmanship, and trustworthiness of the seven passenger touring car The four-cylinder engine is of 20 horse-power, with four cylinders having a stroke of 3⅜ inches and a bore of 3¼ inches. Water cooling is employed. The transmission is of the selective sliding gear type. The multiple disk clutch runs in oil. The rear axle is shaft driven. There are two foot brakes and two emergency brakes. A Bosch high-tension magneto is provided.

Something new in the Garden show is to be found in nearly every one of the models exhibited. Some of the new points of interest are found in axles, transmissions, and in lubricating systems. In bodies, a type that seems to be gaining favor is the four-passenger surrey, which is but a tonneau without doors, built low in the back and sides, yet providing plenty of seating space. The cars at the Garden show range from the costliest on the market down to the little runabout that is cheap enough for anyone.

In 1901, Mr Byron J Carter, then of Jackson, Mich, realizing the shortcomings of geared transmissions as used in automobiles, began experiments for improvements, being naturally attracted to the friction system because of its manifest advantages. After months of careful research, the first Cartercar friction-driven automobile appeared in the summer of 1902. This automobile was of the runabout type, and in addition to the radical improvement in transmission parts, was well designed and constructed. The car has run more than 25,000 miles, and is now, without repairs, apparently in condition for additional service

A remarkable car has been brought out by the Schacht Manufacturing Company, of Cleveland, Ohio The car in question is ingeniously convertible Ordinarily it is a runabout. By the addition of a surrey seat the runabout is transformed into a four-passenger family car The same runabout, by the employment of a special box back, is converted into a light delivery car The vehicle is illustrated on the double page of cars appearing in this issue.

The present four-cylinder Cartercar may be regarded as an improvement of the former two-cylinder model, without a single radical change. This car will appear in the coming season in two sizes. Both have the Carter friction transmission, the nucleus around which the first Cartercar was built

The most grueling sort of endurance contest in which motor cars have participated are 24 hour races As a rule out of about fifteen cars starting in these events only five of them finish at all, the remainder breaking down in the course of the contest from some mechanical weakness. Some cars have started in eight or more of these terrific grinds and have never finished once At the 24 hour race held at the A Y P Exposition at Seattle, a Hudson "Twenty" stock car swept around the course for hours at a time making mile after mile with the utmost consistency in a 1 15 clip The construction of this car is interesting, when its low selling price is considered The rear axle is of the semi floating type, shaft driven, and is strongly reinforced at the points where the greatest shocks and strains occur Two large double-acting brakes are provided at each end of the rear axle The car is built for the man who is satisfied with a speed of 55 miles an hour The motor, four-cylinder vertical, water cooled, is simple, very strong, and amply powerful The transmission is the three-speed sliding gear selective type used on all standard cars.

Official Meteorological Summary, New York, N. Y., December, 1909.

Atmospheric pressure Highest, 30 49, lowest, 28 97, mean, 29 92 Temperature Highest, 54, date, 6th, lowest, 6, date, 30th, mean of warmest day, 45, date, 6th, coolest day, 11 5, date, 30th, mean of maximum for the month, 36 8, mean of minimum, 26 1, absolute mean, 31 4, normal, 34 1, deficiency compared with the mean of 39 years, 2 7 Warmest mean temperature of December, 42, in 1891, coolest mean, 25, in 1876. Absolute maximum and minimum of December for 39 years, 68 and —6. Average daily excess since January 1st, 0 7. Precipitation 5.00, greatest in 24 hours, 2 92, date, 13th, 14th, average for December for 39 years, 3 43 Accumulated deficiency since January 1st, 2 87 Greatest precipitation, 6 66, in 1884, least, 0 95, in 1877 Wind Prevailing direction, west, total movement, 11,964 miles, average hourly velocity, 16 1; maximum velocity, 58 miles per hour. Weather Clear days, 14, partly cloudy, 8, cloudy, 9; on which 0.01 or more of precipitation occurred, 6 Sleet, 13th Snow-fall 11 4

Many an inventor has probably wondered whether the patent law forbids his experimenting with a patented invention The answer is It all depends upon the character of the experiment. Suppose that an inventor is interested in flying machines, and that his primary object is to improve the Wright machine. Has he the privilege of building a Wright machine himself and flying it, in order to study its performance as well as to acquaint himself with the art of flying? We think not. He has no right to *build* the machine for the purpose of learning how to fly or for studying its performance in any way. Had he *bought* the machine from the Wright brothers or their licensees he would undoubtedly have the right to use the machine in that way

1910 Registrations and Licenses.

Inasmuch as considerable doubt, and in some cases confusion, seems to arise in regard to the 1910 registrations and licenses in different States, the Bureau of Tours of the Automobile Club of America has issued a chart showing just what States require registration or license for the new year, where renewals are necessary, and where the old registration or license is still operative. A synopsis of this chart for New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, and Rhode Island is as follows:

New York.—Registration of cars in New York State are perpetual on the car originally registered. If car changes ownership, the new owner must re-register same. If new car is purchased, same must be registered. Transfers are not made.

New Jersey —Registration of car and driving license is required annually, and same can be procured direct from the Bureau of Tours of the Club.

Pennsylvania.—Pennsylvania requires both registration of car and driving license annually, application blanks for which can be procured from the Bureau of Tours. Non-residents, of States that reciprocate, are allowed ten days' exemption from registration.

Massachusetts.—Registration required annually; also driving license for owner and chauffeur Owner's driving license perpetual; chauffeur's driving license good for one year from date of issue—the latter renewed for 50 cents Non-residents exempt for seven successive days Non resident owners may drive, but chauffeurs must procure driving license The Bureau of Tours can procure temporary driving license for non-resident chauffeurs, provided chauffeur can procure certificates of good character and recommendations.

Connecticut —Registrations are annual, expiring December 31st Annual driving license required by owner or chauffeur Non-residents exempt for ten days from registration and driving licenses.

Rhode Island —Registration and driving license required Fees of registration based upon horse-power Non-residents duly registered in home State are exempt for ten days.

Electron—A Metal Lighter than Aluminium.

According to Kosmos, a technical review appearing at Pforzheim, the Griesheim-Electron works exhibited at the aeronautic exposition at Frankfort-on-the-Main its novel patented alloy, the metal "electron," which is claimed to be much lighter than aluminium and at the same time much more durable.

The lightest metal employed for technical purposes up to the present time has been aluminium and some alloys of aluminium, the strength and the durability of which are however lower than those of the new metal The density of aluminium and its alloys has been nearly 3, and they are about twice as heavy as electron The chemical works of Griesheim-Electron has discovered that magnesia is utilizable for technical purposes. By the admixture of magnesia, the price of which is comparatively low, with one or two metals, an alloy is produced of a density of 1 75 to 2, possessing great solidity, strength, and elasticity, and at the same time readily workable The color of these alloys resembles that of silver, and they possess great sonorous quality

The new metal is said to behave very well as regards change of temperature, and it responds to all technical requirements, in the air it becomes covered with a coating of protective oxide. As cast metal, it offers a resistance up to 18 kilogrammes per square millimeter and has at the same time an extension capacity up to 5 per cent. By the processes of condensation, such as compression, rolling, etc., the physical properties of this metal, e. g., strength and elasticity, can be materially improved without its density being increased to any considerable extent. We may thus obtain a tensile resistance up to 35 kilogrammes per square millimeter, and an extension capacity as high as 18 per cent.

By varying the quantity of metal in the alloy and the method of using it, the quantities of electron may be varied within very wide limits. The uses of the metal are therefore very numerous. It is particularly desirable where the object is to obtain extreme lightness and at the same time great strength The physical properties of the metal electron are claimed to be superior to those of aluminium, the proportionate quantity necessary for technical purposes is 60 per cent or more, compared with the weight of aluminium.

It is anticipated that electron will prove exceedingly useful in the construction of airships and automobiles inasmuch as in most of its properties it is superior to aluminium and its alloys. In manufacturing the same object, one would require at least 40 per cent less of electron than of aluminium.

The "Zeppelin" airship requires 6,000 kilogrammes of aluminium, which could be replaced by [illegible] kilogrammes of electron. A large automobile contains, in its mechanism, about 600 kilogrammes of aluminium, which could be replaced, according to the statements of the exhibitors, by [illegible] kilogrammes of electron.

THE MOTOR CAR AND THE ROAD.

(Continued from page 47.)

permanent binders include the petroleums containing an asphaltic base, the residues of such petroleums, the heavy tars, pitches, and numerous oil, tar, and asphalt preparations. In addition to these, a few special materials have been the subject of experiment, such, for example, as the waste product from the beet and cane sugar factories. In some instances glue and bichromate of potash have been added to oil or tar emulsions to cause the residue upon the road surface to harden after the volatile products have evaporated. Waste sulphite liquors from wood pulp have been employed with some success in a concentrated form, and, in fact, the list might be indefinitely extended. The essential requisite in a dust preventive is its binding power, and it naturally follows that the experiments will cover a wide field.

Water, while usually the most abundant and cheapest material, is very often, because of the frequency with which it must be applied, the most expensive to use. Its binding power is almost entirely due to capillarity. The value of the salt solutions commonly used lies in the hygroscopic character of the dissolved salt, which, having considerable affinity for water, keeps the road surface in a moist condition long after a surface treated with water alone would have become dry through evaporation. The light oils and tars, as well as the oil and tar emulsions, are dependent for their effect upon the retention by the road surface of a comparatively small amount of true binding base after the volatile products have evaporated. This base proves effective only as long as it retains its binding power. When the binding power is destroyed, it is necessary to apply more material. If the base is an exceptionally good one, the accumulated products finally harden the road surface and prevent wear to some extent.

The heavy oils and tars differ from the lighter products in that they contain a much greater amount of asphaltum, which constitutes the binding base. The results are, therefore, of a more lasting character, and hence the name permanent binders. The semi-solid and solid preparations usually contain a still greater amount of binder. With some few exceptions, all of the true binders are bitumens, and these bitumens may be either natural or artificial.

The usual method of applying these materials to the road surface is by sprinkling. The temporary binders can usually be applied cold, but the permanent binders, because of their much greater viscosity, must be heated until sufficiently fluid. In England and France the use of coal tar is practised to a large extent and their methods of application have been highly developed. Machines are in general use which are self-propelling and in which the tar is heated and then applied to the road surface as a spray under high pressure. These so-called "tar sprayers" are not only very economical in the use of tar, but insure a more even distribution and better penetration of the road surface than it is possible to obtain in almost any other way.

In the construction of dustless roads, the crucial question is that of cost. Automobiles have but little destructive effect on pavements, but these are in general too costly for country roads. The effort must be to develop a form of construction which will withstand fast automobile traffic and at the same time be within the financial resources of the community. This is largely being done at present by the use of a bituminous binder instead of the rock dust. The two methods generally employed are known as the penetration and the mixing method. In the former, the hot liquid binder is sprinkled or sprayed over the stone and allowed to penetrate through the voids and coat the stones usually to a depth of two or three inches. Some of the devices in use force the binder into the road surface by means of heavy air pressure. In the mixing method, the stones and binder are thoroughly mixed, either by hand or machine, so that each stone is covered with a thin film of the binder. This method in general insures the better and more even distribution of the binder throughout the road surface.

The material used for the binder varies very largely with different sections. In England and France the tars are used very largely. In the western portion of the United States, the heavy asphaltic oils of California are used almost exclusively, while in other sections we find that tars, residuum oils, liquid asphalts, and various proprietary compounds are being used.

One of the chief causes of the great number of failures which have been recorded in the use of bituminous road materials is the failure of the user, as well as manufacturer, to understand certain fundamental principles. To many, a tar is simply a tar and oil an oil, while in reality there is a vast difference sometimes even in the tars produced at the same works. The oils also range from those of a paraffine base to those almost wholly asphaltic. Thus a concise knowledge of the character of the product, the process followed in its preparation, and the effect which varying conditions will have upon it is necessary in order to avoid costly mistakes.

THE MIDDLE WEST AND THE AUTOMOBILE INDUSTRY

(Continued from page 48.)

that the freight has usually been added to the purchase price of the car, and has gone against the consumer, there are many cases in the past, and there will be many more in future, where the cars are sold directly at the catalogue price. For that reason, the location of factories in the middle West was ideal, for it is in truth the center of the automobile-buying public.

In some cases, cities have been made over and their population doubled and trebled by big motor-car factories, as in the case of Flint, Mich., and New Castle, Ind. Such cities have had a tremendous boom in real estate, and in business generally, owing to the influx of 2,000 to 5,000 families, and have assumed an entirely different position on the map because motor-car factories were established within their limits. Besides supplying employment to laborers in large numbers, much money has been made by the leaders in the various enterprises. This has been especially true among the makers of wheels, tires, frames, and other parts. In a general way it may be said that the parts makers have made more money than the automobile builders, as the latter have expended greater sums of money in experimenting.

The total capital of the automobile manufacturers in this country is about $225,000,000. The actual value of the plants will run into some extraordinary figures, and these values are rapidly increasing. As for the output for 1910, it is likely to exceed 200,000 cars, although there may be a slight falling off from these figures, owing to the inability of parts makers to supply the demand. There are now about 150,000 automobiles in use in this country. In a general way, it may be said that the employees number some 120,000 in motor car factories, with employees in parts factories reaching not less than 40,000, a total of 160,000. America may be safely considered the home of the low-priced car, a condition brought about by the tremendous buying power of the middle classes, who demand a car which can be cared for by the owner without the aid of an expensive chauffeur.

These low priced cars have been made possible by ideal factory methods and big production. This necessitated their being standardized, something that may be said to be original with the American maker, who feels that any one of ten thousand parts should be made to fit any one car turned out by his company.

By working on big productions and

keeping prices down, there is little doubt that the American maker will sooner or later figure in the foreign trade This is particularly true in connection with the small, medium priced car, a field that has been neglected by the foreigners With the rapid growth of the business there have been developed many new captains of industry, who as pioneers have blazed the way for motor-car trade, and who are certain to be important factors in future industrial life

The Modern Electric Automobile.

(*Continued from page 51*)

current consumption This arrangement is necessary to keep any excessive rush of current at any tire away from the battery Nothing is more detrimental to the capacity and the life of the battery A rapid increase of current flow and speed from step to step will result in a jerking action in the whole driving mechanism, which of course means rapid wear and possible breakage of the driving parts It is easier to break a string with a short jerk than with an even smooth pull

The limited power carried in one charge of the battery has forced the designer of electric carriages to avoid as far as possible all losses due to friction in the method of transmission of the power from the motor to the wheels as well as in the bearings. The high-speed motor, with its advantage of light weight and high efficiency in starting and in climbing hills necessitates, in the most approved methods of construction a double reduction of speed This means that the motive power is first transmitted with a reduction of speed to a countershaft, and then to the rear axle. The first reduction of the countershaft is accomplished in different ways and with varying success. The earlier carriages used metal spur gears for this purpose, but they proved to be unsatisfactory on account of their noisy running and great loss of power It may be mentioned here that where there is noise there is friction, and consequently where there is friction there is loss of power The next step of improvement was to make the one gear of compressed rawhide A little less noise in running resulted But this construction was still far from being perfect. After passing through the stages of worm and arrow toothed gears, a perfect transmission was obtained when the Renold silent chain was introduced This chain is self-adjustable to pitch after wear In flexibility and high efficiency, it is an ideal, high-speed transmission device It is found to-day on every high grade electric car If kept in proper alignment and well adjusted the life of this chain is indefinite To receive the best service, it must be dust-proof, incased, and kept well lubricated

The power is transmitted from countershaft to the rear wheels on all up-to-date machines by means of roller chains or through a shaft and bevel gears The advantage of one type over the other has been much disputed The greatest objection to the roller chains is their noisy running, their rapid wear, their exposure to dirt and dust, and their loss in efficiency after wear Some reasons for the superiority of the shaft and bevel gear transmission are its quietness, its cleanliness its long life, and its increased efficiency after use Its durability is due to the fact that the bevel gears run permanently in oil and that they are incased. Moreover, the shaft drive does not require any adjustment, and when well designed, all parts of the running gear and power plant will stay in absolute alignment The necessary adjustment of the double chain drive will soon create a variation in the distance from the front to the rear axle on both sides, for two chains will never stretch alike This disadvantage will affect the steering decrease the life of the tires, and result in a loss of power If the chain sprockets are not in proper alignment after adjustment the chains will rub sidewise on the sprockets, which will, of course, shorten the life of the transmission and result in a loss of efficiency

It would be very interesting to measure the distance of both axles on either side of double chain-driven cars after they have been in service in the hands of the average driver and under the care of the average garage for several months to find out if the axles are still parallel Absence of friction is an absolutely necessary factor in the construction of electric automobiles For this reason the proper type of bearings must be applied to the motor, countershaft, and wheels. The ball bearing the highest achievement in bearing construction, has proven to be superior to any other type, and will be found to-day in any high grade automobile Once properly packed with grease this bearing will not require any attention for several thousand miles, if proper sizes for the load to be carried are selected, no wear can be noticed

Every electric carriage should be equipped with reliable brakes. It is important that they should stop the car going forward as well as backward It is not the number of brakes with which a car is equipped but their efficiency, which insures safety Most modern cars are equipped with one of two types, namely the external brake in which a steel band surrounds the drum either on the motor shaft or on the rear wheels, or the internal expanding brake attached to the rear wheels, which is commonly used and generally preferred In this construction two brake shoes are fixed inside a drum A small movement of the brake lever will cause the brake shoes to open out against the inside surface of the drum. The braking action should be applied at the rear wheels. All brakes attached to the motor, if used frequently, are detrimental to the motor and the transmission system. For this reason also, the electric brake which seemed in older days to be inseparable from any electric vehicle, is condemned by the modern designer of electric conveyances Even on the heavy electric street car it had to give room, on this account, to the air brake In many brakes the shoes or bands are operated through flexible steel cords, which is not the best arrangement. A system of steel rods is to be preferred In case two brakes are operated by a lever, a balancing bar should be inserted in the system to insure equal pressure on both brakes.

Tires influence the performance of an electric automobile more than may be imagined Various designs of tires show a variation of up to fifty per cent in efficiency, so that the speed per single charge of the battery is affected. Special points to be borne in mind in the care of pneumatic tires are that rust as well as oil is very detrimental to them, and that it is necessary to keep tires well inflated.

If the storage battery of a few years ago be compared with the up-to-date battery, it will be found that a very much decreased weight with a large increase in capacity and durability has been obtained

The various wire connections on an electric car should be laid with care, and the wire sizes should be large enough to carry the heaviest possible loads without loss of power As far as possible, all leads should be carried directly from the battery to the controller, and then to the motor, and all connections should be tight and securely locked. One common fault in early cars was the loose hanging wires running in different directions, without any attempt at a methodical arrangement. Good insulation is necessary Because it is able to resist acid, weather, and mechanical strain, rubber of good quality and sufficient size has proven to be the best material for this purpose.

HOW TO OVERHAUL A CAR

(Continued from page 53)

son for this is that the shafts, especially gear shafts wear down and must be ground true and no manufacturers seem to appreciate the usefulness of boring repair bushings slightly under size The pilot bushing being solid must be specially made to suit the shaft Aside from this one a skillful amateur can make a good job of scraping his own bushings if he has a suitable set of scrapers and time and patience Red lead is used to test the fit Of course the gear case must come out of the car and at intervals the bushing caps are bolted down tight and the shaft turned to determine whether it is tight or free and whether it makes contact all over

In refitting gear shafts and bushings it is necessary not only to achieve a proper fit but to keep the shafts absolutely parallel If they are not the gear teeth will not bear squarely across their face but will wear away at their corners as exaggerated in the dotted portions Fig 4

In the matter of gear replacements the best result is naturally gained by replacing both mating gears if either is badly worn since otherwise the new gear would have to run against a bad profile and would wear away sooner If the car has side chain drive the differential shaft bushings will need refitting at the same time The parts of a differential which wear fastest are the bushings *A* of the spur or bevel pinions *B* (Fig 5) since these are the hardest things to lubricate To take the differential apart it may be necessary to file the ends of headed over through bolts holding it together In that case the nuts should be reduced in thickness so that the bolts can be headed over again on reassembling (The bolts in Fig [illegible] do not go through) It is very important not to give anything about the differential the slightest chance of working loose and the same applies to the bolts holding the change gears Another point that is difficult to oil and therefore liable to cut is the bearing *C* between the differential or gear hub and the sleeve into which the hub of the differential shell extends This sleeve runs in plain or ball bearings in the case with the shaft or gear hub turning inside of it whenever the car goes around a turn Sooner or later new bushings are needed

If oil is used in the gear case as it must be if plain bushings are used instead of ball bearings it becomes something of a problem to lubricate the bearings effectively without excessive leakage of oil The writer solders a thin wire gauze screen (Fig C) over the interior oil pockets to exclude steel grit worn from the gears In order to prevent escape of oil from the ends of the bushings a felt ring is necessary (Fig 6) This ring would cause the oil near it to become stagnant were it not for a special oil groove *B* which should be chipped entirely around the bushing and connect with a groove *C* by which oil entering it may return to the interior of the case But for this provision particles of dirt getting into the end of the bearing would accumulate and cut the shaft

In the rear axle of a shaft-driven car the thing most likely to need replacement is the differential There are various ways of getting at it depending on the design of the axle casing If the axle is divided vertically in the fore and aft central plane the rear springs must be jacked up and disconnected from the axle and the halves of the axle drawn asunder after taking off the wheels A better arrangement is to have a removable cover plate on the casing through which the differential is inserted and withdrawn This is found especially in axles of the floating type with wheels running on ball or roller bearings on the ends of the axle tubes and driven by floating shafts extending from the differential to jaw clutch plates engaging the outer ends of the wheel hubs To remove the differential the hub caps are first removed and the floating shafts slipped out from the differential without jacking up; then the straps holding down the differential are removed, the bevel driving pinion withdrawn, and the differential lifted out.

Unless a car is more than one year old it is not necessary to assume that the differential needs overhauling. By jacking up one rear wheel and rocking it back and forth, the total amount of slack in the differential may be estimated. It is also usually possible to reach the pinions through openings in the differential shell, and by shaking them to determine whether they are loose. If so, they should be rebushed and the pins or spider replaced if worn. Frequently means are provided for advancing slightly the driving pinion or gear or both to compensate for wear If this adjustment is disturbed the gears should be moved in a straight line and not canted around, else the teeth will engage only at their small or large ends instead of over their full length By rubbing red lead on the teeth and turning the gears, one can tell where the teeth touch

If cup and cone ball bearings are used whether in the rear axle or in the transmission any worn parts should be renewed immediately Fig 7 shows the effect of wear on a stationary ball cone, e g on an axle spindle The pressure comes against the stationary bottom portion and while the cup wears a true path the cone is destroyed It is possible though not always worth while to prolong the life of the cone by giving it a quarter or half turn on the shaft or axle If the cup is stationary and the cone rotates evidently the cup will be the first to wear out of round When one ball of a set is renewed the entire set should be replaced with it

We come now to the engine the last and in some ways the most difficult part to overhaul The owner is strongly advised not to attempt to refit the main crank shaft bearings unless he has had considerable previous experience and knows exactly what to do On the other hand it is not at all hard to regrind and readjust valves replace worn valve lifters and their guides and to do ordinary tinkering and adjusting with the timer carbureter etc It is best not to tamper with the magneto further than to clean the interrupter and adjust the interrupter contact points if worn

To overhaul the engine first strip it of all small gear Take off the magneto first marking the coupling so that it can be replaced exactly as it was, and tag the wires Remove and tag the oil pipes, blow through them to see that they are clear and plug them to exclude dirt Disconnect the carbureter remove the timer take out the spark plugs and plug the holes with waste remove the dust pan take out and mark the valves take off the water pipes, the pump, and the fan Now take off the cylinders If no further dismantling is contemplated the piston heads may be scraped *in situ* taking care that none of the carbon falls into the crank case and the piston rings are likewise cleaned without removal if possible If the rings are leaky as proved by failure to hold compression when the valves are tight new rings are put in and fitted to the locating pins which prevent them from turning At the same time the carbon can be scraped from the inside of the cylinder heads.

Take down the oil pan Test the fit of the wrist pin and crank pin bearings by rocking the pistons and connecting rods on the pins. Do not confuse a rocking motion due to loose fit with end play on the pins A certain amount of end play is always provided A crank pin bushing is likely to wear conical (see shaded area) if the rod is offset as in Fig. 8, and if the rod is springy the bushing may wear bell mouthed at both ends. The crank pin itself will in time wear flat at the point of greatest pressure, as indicated in Fig. 9 It takes more skill than can be acquired off-hand to true it up again, but it can be done with a fine

Swiss file and calipers. It is not necessary to file clear around the unworn portion of the pin, since a slight deviation from its original axis does no harm, neither is it absolutely essential that it should have the same diameter throughout. Its new axis, however, must be absolutely parallel to the shaft It is best to throw away worn bushings and put in new, taking out or inserting shims till a fit is obtained, and scraping no more than is necessary A worn wrist pin bushing must be renewed, and usually the wrist pin must be ground true If the crank pins are oiled through passages drilled in the crank shaft, their lubrication is probably perfect. If, however, they are oiled solely by splash and the oil holes are in the upper half of the crank pin bushing, a considerable improvement can be made by replacing the upper bushings with solid ones and introducing the oil through the bottom half by brazing a copper tube in the cap to act as an *oil scoop* (Fig 10) The bottom half is then drilled and provided with an oil groove for about half its length It is a principle of lubrication that the oil should always be introduced at the unloaded side of the journal and that any breaks in the continuity of the loaded surface merely afford the oil an avenue of escape under pressure

To renew the clutch leather, take off the old leather and use it as a pattern Select the new leather carefully for uniform and correct thickness, and cut it about *half* an inch short The curvature should be approximately that of the old piece (Fig 11) Locate the end and the middle holes for the rivets countersinking them considerably so the rivet heads will not come flush, and soak the strip in water till it has swelled sufficiently to go in place Use the end of a steel bar as an anvil, and put in the end and middle rivots first, holding the strip meanwhile by wire nails The riveting must be completed before the strip dries.

AUTOMOBILE FIRE-ENGINES.

(*Continued from page 55*)

fire engine proper After reaching the scene of the fire the driving gear is uncoupled and the pumps are put in connection with the engines. Such fire engines of course must draw their water from a hydrant, well, or other supply They have done splendid work in suburbs wherever fire engines of suitable power or an adequate high-pressure system can be held in reserve The best of those machines can run to a fire with a crew of seven men at speeds up to 60 miles per hour and carry 1,000 feet of hose The pumps deliver 700 gallons of water per minute at pressures up to 150 pounds to the square inch The regular steam fire engine has a capacity varying from 400 gallons per minute to 1,000 gallons in the case of the largest size of machines. Such a motor fire engine usually contains two 3-gallon chemical extinguishers, and heavy suction hose for hydrant connection, fire axes, nozzle holders, large alarm bell, the usual equipment of lamps, lanterns, tools, and small scaling ladders. In the opinion of many fire engineers a suburban fire station should have two such motor engines, with possibly a steam engine in reserve Again, steam engines may also be held at reserve stations instead of a large number of single steamers. This means considerable economy in the purchase, equipment, and maintenance of a fire house, while the increased radius of action and the speed of the motors enable efficient service to be rendered.

Finally, we may consider machines in which no essential change is made in their construction except to use the gasoline motor and means of propulsion in place of the usual horses. Typical of these are the large combination hose wagons and chemical engines which carry 1,000 feet of 2½-inch fire hose and answer every purpose of the horse-drawn wagons which they are destined to supplant. Fuel for 150 miles can be carried in the gasoline tanks and speeds

up to 30 and 35 miles an hour with full load are easily achieved To carry the heavy hose for the high pressure service of New York city a special automobile wagon has been found most useful and in over a year of service has met every test Put into use in January, 1909, it was successfully operated on snowy and slippery streets and never failed in responding to an alarm This vehicle is built to run up to 30 miles an hour on city streets climb any reasonable grades, and to carry the full strength of a high-pressure company It carries forty 50-foot lengths of 3 inch heavy rubber high pressure fire hose and has a turret nozzle mounted upon the driver's seat from which a powerful siamesed stream can be delivered It takes the place of a three-horse wagon previously employed In fact this automobile truck of New York city has been the logical outcome of the high pressure service in the lower part of Manhattan The future will probably see it extensively used in New York and in other cities provided with high-pressure service

Nor is the use of the automobile confined to the emergency wagons chemical engines combination and hose wagons Aerial ladder trucks up to 85 feet in height are now made for motor traffic and have all the essential features of this important piece of apparatus previously requiring three horses A useful aerial motor truck is mounted upon a 90 horse power four-cylinder automobile the automobile taking the place of the forward wheels thus making a six wheel vehicle slightly longer than the ordinary ladder truck with its horses, but steered by a tiller wheel in the rear in the same manner The whole machine can be turned in its length around corners and is often more easily controlled and regulated than with horses besides being capable of running 25 miles per hour with full equipment and crew on a five per cent grade This apparatus is of interest in comparison with the somewhat shorter ladder devices known as "escapes" which are in use in Europe and which have been developed there to considerable efficiency

That the motor-propelled apparatus is bound to come eventually and to supplant horse-drawn machines seems to be the opinion of progressive fire fighters. Chief Croker spoke in this vein to the writer and said that it was only a matter of expense in the original outlay that prevented motor fire engines from being extensively adopted in the suburbs of the greater city In fact during the last weeks of the past year the Fire Commissioner advertised for bids for furnishing two automobile combination gasoline engines and hose wagons for the borough of Brooklyn and one for the borough of Queens. At present the high efficiency motor fire engines cost more than steam fire engines of greater power, and as fire fighting power is desired first of all, in nearly every large city department, the chiefs prefer heavy units to increased mobility and speed On the other hand the makers of motor fire apparatus claim that the economies of maintenance more than justify the increased expense

There are several questions that enter into the operation of commercial motor vehicles that naturally arise in connection with fire apparatus. One is, the matter of tires, but it must be recalled that the actual mileage of fire apparatus is inconsiderable and that furthermore the best fire vehicles are now supplied with rubber tires, so that there would be no more wear in one case than in the other Fire engines, owing to their portability and the speed with which they must be brought to full working capacity, are notoriously inefficient machines from a mechanical standpoint, and the gasoline engine in no way works for worse conditions. If reasonable economy of operation is secured as well as reliability of service, then with the extraordinary decrease in the cost of maintenance the gasoline motor-driven machine is bound to have a successful future

ANTI JOY RIDE DEVICES.

(*Continued from page 58.*)

other parts of the car by means of attachments fastened inside the hood For example by means of two thumbscrews through the dash, which are inaccessible until the hood is raised, the footboards can be secured against removal, and this will make it impossible to open the cover of the gear box Furthermore, there is combined with the lock a vibration indicator to record movements of the vehicle

Every precaution to render the device proof against tampering seems to have been taken by the inventor, who asserts that it is impossible to start the engine, open the hood, or operate the car without the owner's knowledge or consent unless he has forgotten to withdraw the key or has given a duplicate key into the possession of the chauffeur. In the latter event the chauffeur cannot take the car out on the road without having the approximate distance traveled registered by the vibration recorder

The only visible part of the device is a polished brass plate 2 by 4 inches in size which is set into the dash. In the upper part of this is set a casting containing a compact switch for use with any system of ignition and, also a Yale lock provided on its inner end with a cam plate and contact piece. The lock key takes the place of the usual switch lever, and the switch cannot be operated without it. It is also impossible to remove the key until the switch has been turned to "off" position.

Two bell-crank levers surrounding the barrel of the Yale lock behind the switch are operated by the cam plate of the lock, and their long arms are attached to small steel cables that pass through eyelets screwed into the dash under the hood These cables lead to two special spring latches secured to the lower inner corners of the dash in a position to engage the slots cut in strips of angle iron riveted to the inside of the hood on either side. Thus, when the key and cam are in open position, as shown in the drawing, the latches are withdrawn and the hood can be raised, but when the switch has been turned to "off" and the key removed, the latches are released and hold the hood against all attempts to raise it. The engines may be run with the hood open, and the hood will lock automatically when closed

In a special recess directly beneath the Yale lock is placed a vibration recorder, resembling a pedometer in appearance and action, which is held securely by a plate provided with a spring to press against the back of the instrument. The vibration recorder is so adjusted that it will not be affected by the running of the engine while the car is at rest, but will record the vibrations of the car when in motion The plate is sealed by a wire and lead seal and also by a strip of paper pasted across the back with the owner's name written thereon, and if these seals are broken explanations from the chauffeur are in order, as he is the only person except the owner who has access to the hood chamber. The switch can be removed without disturbing the sealed chamber holding the recorder, but only after the hood has been raised. It is impossible to remove any part of the mechanism from the exposed side of the dash.

MAKING YOUR OWN REPAIRS.

(*Continued from page 69.*)

graphite, and in order to apply it, the springs must be relieved of the weight of the car To do this, apply jacks to the corners of the frame, and operate them until the tires are clear of the ground. The weight of the axles and wheels will

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President Arthur T Hadley, of Yale

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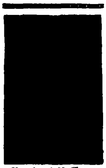

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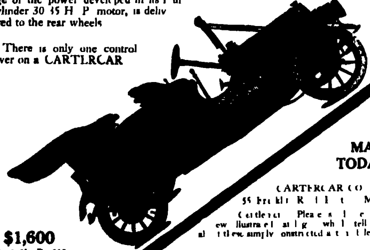

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(Continued from page 70)

then be suspended from the springs, and in almost all cases it will cause the leaves to separate sufficiently to permit the lubricant to be introduced by means of a thin bladded table knife

CLEANING THE OILING SYSTEM

It occasionally happens that the oiling system becomes clogged, either from the thickening of the oil or the introduction of dirt and grit.

In the majority of cases this may be cleared away by draining the oil from the tank and crank case, putting a pint or two of gasoline into the tank, and cranking the engine briskly The gasoline will thus be forced through all parts of the system, and will cut out the thick oil and dirt Before refilling the tank with oil, the gasoline should be drained out and time allowed for it to drip out of the piping

CUTTING A GASKET

To prevent the leakage of oil the cover of a gear case usually rests on a gasket, which may easily be injured or destroyed when the cover is removed. Its shape makes it seem a difficult part to replace, but as a matter of fact it is a question of only a few minutes work to replace it

The material to use is smooth and uncreased brown wrapping paper of medium weight, and of a surface that is not too highly glazed Clean the top of the gear box and lay the paper over it, then with a light hammer tap the paper where it rests on the outer edge of the flat part The edge cuts through the paper where the hammer strikes, and to get the gasket to proper shape it is only necessary to follow the edge all around To prevent the slipping of the paper, the first step might well be to cut two bolt holes through it, and to insert the bolts The holes are cut by striking the paper over the bolt holes in the gear case, using the ball end of the hammer

The inside opening is cut in the same manner as the outside Before applying the gasket, give one side a coat of red lead and the other a coat of shellac, and in placing it in position have the shellac side down, or in contact with the stationary part The gasket will then cling and will not be torn on any subsequent removal of the cover

A gasket made in this way will give excellent results under the detachable head of a marine or stationary engine, but after fitting it the engine should be run sufficiently to get normally heated before finally setting up the nuts or bolts that secure the head to the cylinder

TO REMOVE A DENT

Aside from its unsightliness, a dent in a tube, radiator housing or other metal part may interfere with operation, and it becomes necessary to remove it To do this form one end of a piece of stout copper wire into a loop, and solder it to the lowest point of the dent. Then exert a strong and steady pull on the wire, at the same time tapping the borders of the dent with a light hammer When the dent is thus pulled out the solder may be melted off and the finish restored with fine emery and crocus cloth.

A dent in a gasoline tank is more difficult to remove on account of the greater stiffness of the metal, but it may be accomplished by the use of a discarded valve Clean the valve head with emery cloth and solder it, not to the bottom of the dent, but to one of the sloping sides. The valve stem then forms a sort of lever by which the dent may be pried out

REPAIRING A SPLIT TUBE.

The copper and brass piping used for gasoline and water connections has a tendency to split, and an injury of this sort apparently calls for a renewal of the part. This, however, is not always necessary, for a permanent and sightly repair is a comparatively simple matter.

The work is begun by winding No 14 soft copper wire around the split portion of the pipe, and a half-inch beyond each end. Then, after heating and applying soldering solution, the windings should be soldered together and the outside windings soldered to the tube. This will form a tight jacket around the split portion of the tube, and will save the very considerable expense of a new part.

LINING UP THE WHEELS.

While it is not generally realized, yet it is none the less true that the failure of tires to give good service is in many cases due to the wheels being out of line. This may be caused by misadjustment, sprung steering-rod or arms, a twist in the axle from road shocks, all of which result in throwing the wheels out of parallel with the center line of the car If the wheels are set correctly, they will have a true rolling motion on the road, and the slightest deviation from this position will set up an additional sliding action that is destructive to the tire surfaces.

In testing the parallelism of the wheels it may be taken for granted that the side members of the frame, as well as the springs, are parallel Starting with a rear wheel, measurements should be made of the distances between the spring and the forward and rear portions of the felloe, at points as nearly as possible on the level of the axle These measurements should be equal, and should be the same as corresponding measurements made on the opposite side of the car If the figures indicate that the wheels are equally out of parallel with the springs, matters may be set right by making a proper adjustment of the radius rods.

To test the front wheels, manipulate the steering gear until measurements show one wheel to be parallel to its spring, it will be necessary to adjust the drag link, which is the bar connecting the steering arms of the two knuckles.

Another method of testing the wheels is to stretch a string along the sides of a front and rear wheel, just above the axle. With the steering gear set for straight running the string should touch each wheel at two points, as indicated in the diagram If the wheels are not true, the string will touch at one point only, as illustrated

LOCATING ENGINE NOISES

The writer was once called on to locate a knock in an automobile engine belonging to a doctor There was no question as to the cylinder, nevertheless even the use of a stiff wire, one end held in the teeth and the other resting against the engine, failed to determine whether the trouble was in the crank pin or wrist pin.

The sight of a stethoscope in the doctor's pocket suggested its use, and the knock was immediately located in the wrist pin. A stethoscope now takes an important place in the writer's testing equipment, and he believes that it will be found invaluable in the repair shop By its use looseness in a bearing may be detected long before it becomes serious, escaping gases may be heard hissing past worn piston rings or pitted valves, and other noises that indicate slight faults are brought to the attention of an intelligent user

TIMING MAKE-AND-BREAK IGNITERS.

Under usual conditions it is difficult to time igniters with any degree of accuracy, but it may be accomplished with surprising ease by the use of an electric bell, a battery and wire. One side of the battery is to be grounded, the other connected to the bell, and the circuit continued to the insulated part of the igniter, as shown in the diagram. When the igniter is not making contact the bell circuit is open, but when the piston is moving on a compression stroke the igniter makes contact, and the bell rings.

When the spark control lever is in the retarded position, the igniter should break contact when the piston reaches the top center of the compression stroke. To make the adjustment, crank the en-

(Concluded on page 74.)

(Concluded from page 72)

gine until the piston is in this position, and then adjust the tappet until the igniter just breaks contact and the bell stops ringing. To test, crank the engine until the piston again makes a compression stroke and the bell begins to ring Continue to crank, proceeding slowly, and observing the position of the piston by means of a wire passing through a relief cock, or by marks on the flywheel The bell should stop ringing at the instant when the piston reaches its topmost point

LACING A FAN BELT

The requisites for joining together the ends of a flat lacer belt are rawhide lacing ¼ or ⅜ inch wide and a round punch of such size that it will cut a hole in which the lacing will make a snug fit For a fan belt of average width three holes may be punched in each end, the outside holes ⅜ inch from the end and the center one ⅝ or ¾ inch in, the holes in the two ends being in line The relative positions of the holes are shown in the diagram The lacing is passed through the holes in the manner indicated and drawn tight To secure the end a cut is made on each edge of the lacing, extending inwardly for one-quarter of the width, the knife being laid flat on the belt The lacing is cut off ⅛ inch farther up The end may then be flattened out, and the wings formed by cuts will prevent it from pulling through the hole

The belt will stay in position only when the stitches in contact with the pulley are parallel to the pulley edge If the belt is placed on the pulley so that the slanting stitches are in contact with the pulley face it will tend to ride off

In an emergency heavy wire picture cord of the ordinary stranded variety may be used in place of rawhide The only objection to its use is the click that it makes in coming in contact with the pulley

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

RECEPTACLE FOR BABY CLOTHS.—C Brewer, New York, N Y The invention provides a receptacle for baby cloths and other articles of wear offensive for manual handling in which the washing may be performed provides for operating the receptacle in the bowl of a water closet, utilizing the flushing water of the bowl, and wherefrom the water may be drained from the bowl provides holding devices for the receptacle to retain the same in operating position provides for flushing water in the bowl and means for preventing flooding of the bowl to overflow the same

Of Interest to Farmers.

COTTON PICKER.—G Sickel, St Joseph, Mo. The objects of the inventor are to provide a mechanical contrivance for picking cotton, a device for mechanically controlling the cotton as picked and a mechanism which will perform its functions without damage to the growing plants and to lessen the labor incident to picking by hand.

WEED EXTERMINATOR.—E. A Francis Marshalltown, Iowa The intention here is to provide a device compact in form, so that it can be easily carried about by the operator, and which is so constructed that the mechanism whereby the liquid is discharged from the body will not become clogged by dirt as the lower end of the body is forced into the ground.

AUTOMATIC FOWL DUSTER.—O E. Ruffin Enumclaw Wash The invention has for its object a duster in which the container for the dusting material is movably mounted and driven by the frictional contact of the fowl in passing under it the container being adjustable to different elevations to suit fowls of varying heights

TRIP MECHANISM FOR CORN PLANTERS.—H F Herrmansohn Alcester S D The purpose of the invention is to provide an improved trip mechanism, especially adapted for use with corn planters, but capable of use in any device where it is desirable to operate one part intermittently by means of a continuously moving part

Of General Interest.

REINFORCED CONCRETE CONSTRUCTION.—S. H Summerscales Winnipeg Manitoba, Canada The improvement refers to reinforced concrete construction and the object is to provide a simple construction in which the metal reinforcing parts are connected in a manner so as to form an efficient reinforcing skeleton for concrete walls, floors and similar constructions.

BRACE FOR BRICK KILNS.—A Prausse, Kingston N Y In this case the object is to provide a brace which is adapted to brace the sides of a brick-kiln to serve as a support while the bricks are being baked. The brace is adjustable so that it may be fitted between a side of the kiln and a framing spaced therefrom, without endangering the workmen in charge of the work.

LOOSE-LEAF BINDER POST.—F. H. Crump, Los Angeles, Cal. The posts are provided with a head which will so engage the top binder plate as not to protrude through it. The bolt (male and female) will remain together when the top cover has been removed. The post is for use with a round hole sheet, which will not come off the post though held loosely between the covers.

SCALE.—C. M Sturgis, Birmingham, Ala. The principal objects here are to provide a structure which may be readily extended, a structure wherein the moving parts are securely and simply mounted, a structure having a multiplicity of carrying beams with a single adjusting member, one wherein the platform may be supported upon end rails without interfering with the moving parts of the scale proper

LOOSE LEAF BINDER.—J M. Lull, Wausau, Wis. The invention relates to a special form of binder for holding the sheets of loose leaf books. The patentee provides for each group of leaves a novel form of clamping plates having specially designed interlocking lugs that clamp the plates together and engage the leaves of the book.

Hardware.

WINDOW LOCK.—I C Scudder, New York, N Y The invention relates to certain improvements in window locks, and more particularly to a locking device adapted to be detachably secured to the lower portion of the upper sash to limit the extent to which this sash may be lowered or the lower sash raised.

JACK.—W B. McCain, Clearlake, Wash The jack in this improvement is of the double action type and in operation lifts the load step by step or lowers it in like manner according to the relative disposition of certain parts and it is provided with means for entirely releasing the lifting bar whereby the latter may drop instantly to initial position

HASP-FASTENER.—H L. Lambrecht Sullivan, Ill The invention is an improvement in hasp fasteners, and has for its object a construction in which the latch bolt is automatically engaged in a notch or recess in the keeper when the hasp is swung to locking position, thus preventing the withdrawal of the hasp until the latch bolt is retracted.

PITCH BOARD.—C E Lytle, St. Joseph, Mo This measuring instrument is more especially designed for use by carpenters to enable them to accurately obtain the length and bevels of rafters, thus enabling a carpenter to frame the roof of a building with ease and dispatch and without the use of a square or a bevel and without requiring mental calculations.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each Please state the name of the patentee, title of the invention, and date of this paper

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 18th or will be sent by mail on request.

(12168) J R. U says 1 Could you tell me the supposed speed of Arcturus per minute and its probable distance from the north star? A It is difficult to give a velocity for Arcturus. The researches of Prof. Elkins some years ago are fully reported in our SUPPLEMENT No. 809, price ten cents. These tend to make us believe that the velocity of Arcturus is very high, about 380 miles a second, and its distance from the earth about 180 light years. The approach of Arcturus toward the earth is about 83 miles per second. These researches were published nearly twenty years ago, yet there are no later determinations, and they are the ones given in our textbooks of astronomy. We do not know its probable distance from the north star Probably that has not been determined. 2. Is the north star the center of attraction around which the circumpolar constellations move? A. The north star is simply the star which at present happens to be nearly in the line of the earth's axis prolonged to the celestial sphere. As the earth's axis is in motion around the pole of the ecliptic, the pole will move away from the present pole star and will not return to its present position till 25 000 years have passed. The pole star is not a center of attraction in any sense. It is simply a pole star to the earth at the present time, and the constellations seem to move around it as seen from the earth and not as seen from other stars.

(12169) G. F. B. says: I would like

to secure a book giving a complete course of experiments in physics for the first year in high school. It is especially in electricity I would like a course, beginning at the very bottom and working up by simple and readily intelligible experiments. Have you such a book, or can one be procured from some of the large book supply houses? A. We recommend and can supply you with Carhart and Chute's "High School Physics," for $1.35 postpaid, and also Chute's "Laboratory Manual of Physics," for 90 cents postpaid. With these you will be equipped for learning the work in elementary physics up to the entrance to college. The work is graded just as you request, and is just what is done by everyone fitting for college in the United States to-day.

(12170) J. S. says: 1. What is the exact length of a sidereal and a tropical year? A. The sidereal year is in mean solar time 365 days, 6 hours, 9 minutes, 8.97 seconds. The tropical year is in mean solar time 365 days, 5 hours, 48 minutes, 45.51 seconds. These are not exact, but are correct within a hundredth of a second. 2. What do you hold of water witching? Do you think a person can locate water in the ground with the aid of a forked switch? A. We do not "hold" anything about "water witching." We do not believe that water can be located underground by a stick.

(12171) A. J. H. says: Some time ago you had an explanation published in your SCIENTIFIC AMERICAN of how a square of 64 inches on changing the angles became an oblong with 65 squares. Please advise me how this is done and where the fallacy comes in. A. You will find the explanation of the fallacy of the cardboard square, cut to appear to increase one square inch in area, in our Notes and Queries of Vol. 99, No. 21, which we send for ten cents. The article occupies more than a column and is illustrated by drawings to scale.

(12172) H. C. A. says: What is the chemical symbol for litmus? How is litmus paper made? Why do the acid and alkali have the property of changing the color of it? A. Litmus is a natural dyestuff of unknown chemical structure. Doubtless one of its colors is that of the molecule, the other that of its ion. Litmus paper is made by preparing a solution of litmus in water, soaking filter paper in the solution, and allowing it to dry. If red litmus paper is desired, the solution is reddened by a drop of an acid before the paper is dipped into it.

(12173) E. R. S. says: Please decide this question and oblige a subscriber. A states that in sending a message by telephone the transmitter vibrates, and this vibration travels over the wire by an electric current. B states that when the transmitter and receiver are fully connected between given points of any distance that space is eliminated in the sending of a message, therefore no travel is necessary or time consumed. A. If we understand your statements neither A nor B is wholly right. We should state the action of the telephone in this way. When the diaphragm of a transmitter vibrates the variation of pressure upon the carbon particles in the transmitter causes an undulation in the current from the transmitter to the receiver at the other end of the line. In this receiver an undulation is produced of the same period as that in the transmitter; this causes a vibration of the diaphragm of the receiver, which is heard as a sound by the person who is receiving the message. Along the line a varying electric current flows. There is only an electric current along the line. There is sound at both ends. The same time is required for the impulse to travel from transmitter to receiver as would be required for a telegraph signal to travel over the same wire to the same distance.

NEW BOOKS, ETC.

EXTRACTS AND PERFUMES. By Wilbur L. Scoville, Ph.G. Boston: The Spatula Publishing Company. 16mo., 101 pp. Price, $1.

This is a valuable treatise on the most practical methods for the manufacture by the retail or wholesale pharmacist of flavoring extracts, colognes, toilet waters, perfumes, sachets, fumigating pastilles, etc. It is an excellent book on the subject.

THE PREVENTION OF INDUSTRIAL ACCIDENTS. By Frank E. Law, M.E., and William Newell, A.B., M.E. New York: The Fidelity and Casualty Company of New York, 1909. 16mo., 194 pp. Price, 25 cents.

The prevention of industrial accidents is one of the most important subjects which have come to the fore in the opening years of the present century. The American Museum of Safety and Sanitation has obtained a more or less secure foothold in the counsels of great manufacturers and great industrialists are to be found on its board of trustees. Strange to say, the insurance companies, instead of being antagonistic, have done everything in their power to support and promote this movement, and they have, may it be said to their credit, contributed much of the sinews of war to the organization referred to and to similar enterprises. The position of the SCIENTIFIC AMERICAN as regards the

prevention of industrial accidents is indicated by the fact that this journal offered a prize, a handsome gold medal, for the best device for safe guarding life and limb, and this medal is awarded annually when there is a competition held by the American Museum of Safety and Sanitation The small pamphlet before us is filled with information of the greatest possible value, and it is truly a life saver"

Holland of To-day By George Wharton Edwards. New York Moffat Yard & Co, 1909 8vo, 217 pp Price $6

It is a pleasure to look through this splendidly made book, in which the author artist and the publisher have collaborated to produce a *chef d'oeuvre* Mr Edwards is an accomplished master of line and a brilliant colorist and the somewhat gaudy tints of a Holland costume and landscape are brought into their proper key in the splendidly colored illustrations with which the book is embellished To those who know their Holland well this book is a great treat, while it is especially commended to those who are unfamiliar with this tight little country, and to whom it will serve as an excellent guide The text is a matter-of fact description of what the traveler may find in Holland to-day, and he will glean many interesting facts such as the plurality of cheeses at breakfast, the growth of tulips, and information as to the head dresses of Friesland The illustrations showing old Dutch silver are particularly valuable The binding is most sumptuous

The Spatula Label Book By Wilbur L. Scoville, Ph G Boston The Spatula Publishing Company Price, $1

This valuable book is indispensable to the druggists comprising labels for practically all the drugs chemicals and preparations of the United States Pharmacopeia and the National Formulary, together with many for drugs in the British Pharmacopeia, and for a large number of unofficial articles, utensils, apparatus, etc In all over 2,000 labels. These labels are printed in large type on paper which is easily pasted on bottles, drawers, etc. It is worthy of a considerable distribution

Time and Its Measurements By James Arthur Chicago Popular Mechanics, 1909 8vo, 64 pp Price, $1 50

This rather interesting book describes ancient methods of keeping time Japanese clocks modern clocks, and the astronomical foundation of time It gives a considerable amount of information not readily obtainable elsewhere

Hand Book of British Guiana 1909 Edited and compiled by George E Bayley of the British Guiana Civil Service Georgetown, Demerara, British Guiana 8vo, 607 pp Price, $2

This portly volume describes everything which anybody would possibly want to know about British Guiana, and is a most creditable work on a most beautiful and interesting country

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Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. In every case it is necessary to give the number of the inquiry. Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

FOR SALE

Inquiry No. 9018.—For manufacturers of "Wydt's Electro-Catalytic Sparking Plug."

FOR SALE.—Engine lathe, swings 9½ in., takes 25 in. between centers. Complete with full set change gears to cut all size threads, 8 to 40 in. Price only $40.00. Address L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9000. For information regarding shoes not made of leather but similar to the same and are as durable.

PATENTS FOR SALE

Inquiry No. 9007. Wanted the manufacturers of the Van Winkle Woods & Sons, and the Weber power meters.

PATENT FOR SALE.—No. 908,788. Reverse Gearing—arrangement for a straight Belt instead of the annoying twisted Belt. A money maker for the right party. For sale outright. Apply L. Klein, Egg Harbor City, N. J.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

FOR SALE.—Patent No. 936,373 on improved screw. Can be applied to wood screws, lag screws or any article having a screw point. For particulars, address Otto Rehse, Germantown, California.

Inquiry No. 9016.—Wanted, machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

WANTED

Inquiry No. 9023. Wanted to buy silk machines from re-reeling, twisting, doubling, to the final process of making it into clothes.

A WANTED, Wireless patents. Advertiser desires to purchase wireless telephone and telegraph patents for either Canada or the United States or both. Write stating full particulars and cash figure on same. Address L. V. U. Suite 605, 41 Park Row, New York City.

Inquiry No. 9025.—Wanted, address of rubber manufacturers in Germany.

MISCELLANEOUS

Inquiry No. 9029.—Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

HAIR GROWS when our Vacuum Cap is used a few minutes daily. Sent on 60 days' free trial at our expense. No drugs or electricity. Stops falling hair. Cures dandruff. Postal brings illustrated booklet. Modern Vacuum Cap Co., 558 Barclay Block, Denver, Colo.

Inquiry No. 9036.—Wanted, the address of the manufacturers of "Cycle Ball Bearing Suspenders."

LISTS OF MANUFACTURERS

Inquiry No. 9038.—Wanted the address of the Chipman Electric Purifying Co.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9042.—Wanted the address of Farney Safety Razor Co.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9044.—Wanted to buy outfits necessary for agate polishing.

Inquiry No. 9046.—Wanted machinery used for the manufacture of all kinds of fruit boxes, baskets and crates.

Inquiry No. 9048. Wanted, address of manufacturers of metal table slides for extension tables.

Inquiry No. 9049. Wanted to buy rotary brushes suitable for a shoe shining machine.

Inquiry No. 9052.—Wanted to buy machinery etc., for a beer plant that manufactures beer by means of glucose.

Inquiry No. 9053.—Wanted address of firms who install plants to manufacture nitrogen.

Inquiry No. 9054. Wanted address of manufacturers of articles made from mica.

Inquiry No. 9055.—Wanted address of parties interested in Log Cleaning Machines.

Inquiry No. 9056.—For manufacturers of window shades.

Inquiry No. 9057. For manufacturers of glass and china balls, used as fixtures or ornaments on lightning rod equipment; also weather vanes for same purpose.

Inquiry No. 9058. Wanted firms who make machinery used for pulverizing soap-stone.

Inquiry No. 9059. For manufacturers of flexible steel chain mail.

Inquiry No. 9060. Wanted to buy machinery to manufacture seed corn racks.

Inquiry No. 9061.—Wanted the address of manufacturers of auto magnetos and permanent magnetos.

Inquiry No. 9062. Wanted to buy a plant for manufacturing muriatic acid.

Inquiry No. 9063. Wanted to buy a machine that would wrap and tie up a loaf of bread.

Inquiry No. 9064. For manufacturers of a cigarette making machine constructed as follows: a small metal box containing tobacco and papers, the cover contains a piece of cloth upon which is placed the paper and tobacco, the cover being closed the cigarette jumps forth.

Inquiry No. 9065.—Wanted to buy a second hand telephone generator.

Inquiry No. 9066. Wanted complete outfit for export for making rice-flakes and wheat-flakes.

Inquiry No. 9067.—Wanted the address of makers of the Standard Folding Typewriter.

Inquiry No. 9068. Wanted to buy machinery for manufacturing chewing gum, such as rolling, cutting or wrapping machinery.

Horse loader and backer, automatic, L. H. Bouviere ... 945,[illegible]
Horseshoe, R. C. Meyers ... 945,[illegible]
Horseshoe with elastic bridge covering both ends, E. Schmitz ... 945,[illegible]
Hose nozzle, W. H. Perkins ... 945,[illegible]
Hose, steam, W. T. Bonner ... 945,[illegible]
Hydrocarbon burner, J. C. Calligan ... 945,[illegible]
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Ignition apparatus, E. D. Bright ... 945,[illegible]
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Wheat heater, J. G. Hagmann 945,090
Wheel, E. Hoserth 945,668
Whiffletree clip and hook, J. Herman 945,323
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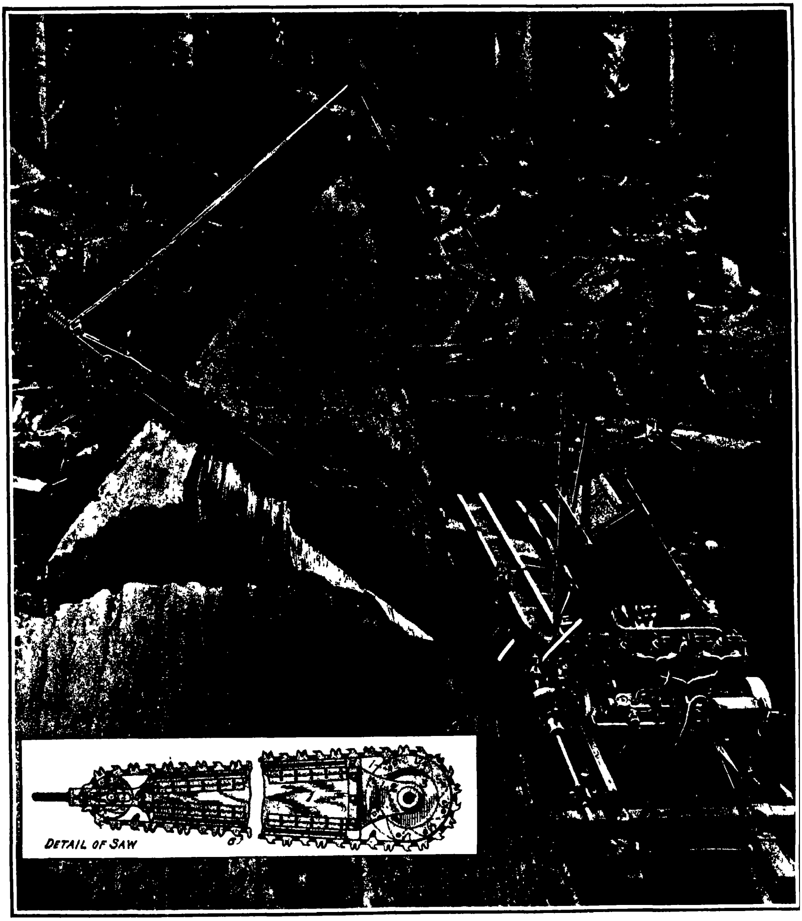

The saw is a chain with tooth-links passing over grooved guide wheels at the ends of a frame.

CUTTING A REDWOOD TREE WITH A SAW DRIVEN BY AN ENGINE.—[See page 86.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

ADAPTABILITY OF THE GYROSCOPIC CAR TO RAILROAD SERVICE.

BRENNAN and Scherl, each working independently of the other, have recently proved that a car containing a pair of gyroscopes can be run upon a single rail and maintain its stability under varying conditions of eccentric loading, side winds, and curving track. Upon seeing a practical demonstration of this fact, and submitting the car, as the writer recently did, to various severe and successfully-endured tests, it is natural, in the first moment of enthusiasm to predict an immediate and widespread application of the system, or even the eventual abandonment of the present two-rail track and trains in favor of the monorail type Sober second thought, however, must convince any thoughtful and practical mind that, in spite of the brilliant results of the recent demonstration, the monorail gyroscopic car, in the nature of things, can have only a more or less limited application under present-day conditions. We wish it to be distinctly understood, of course, that any criticisms which follow are in no sense hostile, and are made with a full appreciation of the skill and knowledge, both theoretical and practical, with which the car now being shown in this city has been developed

THE CAR.—Mainly because of its perfect adaptability to take the curves, whatever the degree of sharpness, with a minimum risk of derailment, the promoters of the system claim that trains of this type will be run at speeds from fifty to one hundred per cent greater than those that are possible on two-rail track Now if the new system is to compete with the old, the trains must provide at least the same capacity and comfort as the present Pullman trains It is stated that, in such cars, the weight of the gyroscopes will represent about 8 to 9 per cent of the weight of the car Structurally, the monorail car must be at least as strong, being supported, like the present type, on two points, namely, the centers of the two trucks. The trucks, however would be lightened by the reduction of the number of wheels per truck from six to say four, and as the axles would be shortened, it is probable that the weight saved in this way would be about equal to the 8 or 9 per cent represented by the weight of the gyroscope mechanism Hence, it is not likely that there would be any reduction in the weight of the car as a whole The gyroscopic mechanism, on the other hand, would be an extra cost and certainly not a very light one In the very nature of things, it must be most carefully constructed and of the very best material The motion of the car would undoubtedly be easier The lateral swaying and shocks incident to the present two-rail system would give place to a very gentle and probably imperceptible rocking motion, due to the controlling action of the gyroscopes On the curves the riding of the new type would be greatly superior, the sudden jolting of the cars against the outer rail, and the uncomfortable swaying of the passengers in the same direction when the cars are running at high speed would be entirely wanting except possibly on entering and leaving the curves Under the two-track system, the car is placed in a favorable position for entering the curve by the gradual elevation of the outside rail for a distance of from 150 to 200 feet before the curve is reached, and also by laying out the first portion of the curve as a spiral with gradually decreasing radius. If some means can be found to throw the gyroscopic car slightly toward the inside of the curve before the latter is reached, it would be advisable to incorporate it.

THE TRACK.—Although the claim which is so frequently made that there would be a simplification of the track and a lessening of its cost is justified by the facts, these advantages would not be so great as might at first be imagined. One line of rails would be dispensed with altogether, it is true; but the remaining rail would in any case have to be made far heavier and stiffer; and if, as is claimed, the speed is to be *doubled*, probably some altogether new system of track would have to be devised. In the first place the concentrated weight on each set of wheels would be exactly doubled, and, since the dynamic shocks upon the track, culverts, bridges, etc., are directly related to the momentum, and the momentum increases directly as the weight and as the square of the velocity, it follows that the dynamic stresses upon the rail, due to lack of perfect alignment, low joints, slight deviations from the true line of the curves, would for double the velocity be just eight times as great with a sixty-ton gyroscopic car as they would be with one of the ordinary type. This could be met by devising a rail with a head several inches in width, and with a depth at least twice that of the present rail. It is doubtful if the present system of cross ties and stone ballast would present sufficient solidity, and some form of permanent masonry roadbed would seem to be a necessity, at least for carrying express trains of the proposed speeds of one hundred miles an hour and over.

In the case of long-span bridges, the concentration of the weight on the center of the floor would call for increased strength in the floor beams, although in the case of deck bridges where the floor is laid upon the top chords, the trusses or plate girders might be brought somewhat closer together.

The cost of maintenance would undoubtedly be considerably reduced, since the labor entailed in keeping two rails to gage and in maintaining the proper superelevation of the outer rail on curves would be entirely eliminated. On the score of safety, provided a suitable form of track were built, the argument is entirely in favor of the gyroscopic car, and especially so on the curves.

It seems to us that if there is a future for the new system, it will be found in the construction of pioneer railways through undeveloped country, and particularly through mountainous and hilly country where the line must of necessity be very circuitous. The self-adjusting qualities of the car enable it to run around curves which would be altogether impossible for a two-track railroad The monorail track could be located around a hill or bluff, through which a two-track railroad would have to pass with heavy and expensive excavation Moreover, for this class of railroad a much lighter car would be practicable and extremely high speeds would not be demanded. This decrease in weight and speed would mean a great reduction in first cost and subsequent cost of maintenance of the system If the new type should demonstrate in service of this kind its commercial practicability, it is quite conceivable that it would be gradually applied to the more important lines of travel, and eventually to the main trunk roads.

IMPORTANT INVESTIGATIONS REGARDING THE PROPULSION OF SHIPS.

IMPORTANT investigations, marking a new era in the study of the propulsion of ships, are about to be undertaken by the Naval Architecture Department of the Massachusetts Institute of Technology, under the direction of Prof. Cecil H. Peabody, the head of the department, and a corps of assistants and associates

Already a navigable forty-foot model is in process of construction, funds for the maintenance of this work being provided by a friend of the department. In order that the investigations may be of a practical nature, directly connected with the actual conditions of ship propulsion, the model is being patterned after the U S. S. "Manning," and will be on a one-fifth scale. The choice of the "Manning" as a type of ship for the experiments is made because Prof Peabody, under whose direction the work is to be done, was directly connected with a remarkable series of speed trials on board the ship, which were reported to the Society of Naval Architects and Marine Engineers in 1899

After the relations between the actual trials of the ship and those of the navigable model have been established, a certain basis of determination will be furnished, by which it will be possible to determine what may be expected of a full-sized ship, before the latter is built. The method which it is proposed using has been tried successfully in Great Britain to some extent, particularly for such types of vessels as the "Mauretania" and "Lusitania."

Messrs. Denny Brothers of Dumbarton, England, have a private model basin in which they have developed new types of ships, and in the case of the Japanese vessel, the "Otaki," which was built by this firm, just such a navigable model was used to determine the capacity and power of the novel combination of reciprocating engines and low-pressure turbines.

The department has been promised the co-operation of the model basin at the Washington navy yard, and preliminary tests are to be made there very soon on a [illegible] twenty-foot [illegible] diameter.

The problem of propulsion [illegible] Peabody, three [illegible]: first, [illegible] of the ship, or the force required to maintain the given speed; second, the power applied to and delivered by the propeller; and third, the effectiveness of the combination of propeller and ship. From necessity the choice the propeller is placed at the stern of the ship, where it can take advantage of the wake, but where it also disturbs the natural flow of water, and consequently increases the resistance considerably above what the pull on a tow rope would be. This combined effect is exceedingly complex and obscure, and consequently has given rise to more difficulty than any other problem connected with the propulsion of ships. This is the particular problem which has been chosen for investigation by aid of the navigable model.

The model is building at the yard of Stearns & McKay at Marblehead, and the propulsion machinery has been already designed. It will consist of a gasoline-electric generating set and a motor geared for experiment work, so that conditions may be controlled over a wide range, and the measurements of power may be simple and accurate. The machinery can also be easily transferred to other hulls as the work progresses.

Upon the completion of experiments with the model built and engined to correspond with the prototype, various forms and locations of propellers will be experimented upon, including twin and triple-screw propellers, especially of the type used at present with marine turbines. The form of the hull will then be changed so far as may be without rebuilding, and the hulls of various forms of ships will be built to extend the range of the experiments.

Another important problem to be undertaken will be the steering and maneuvering, including practical work in rough and stormy seas. As this field has received but little attention in the past, much new and valuable information will be acquired.

This proposed method of investigation has the considerable advantage that a proposed design may be tried on a small and inexpensive scale simulating all the conditions of actual service, including the performance of the ship under adverse weather conditions. After satisfactory conditions have been attained by use of the model, the dimensions and conditions can be determined for the full-sized ship by the theory of mechanical similitude. The fact that this theory leads to the assignment of somewhat higher power to the ship than may be needed gives the designer a margin that may be taken advantage of, but which can be controlled by the preliminary experiments with a full-sized ship for a prototype.

The equipment will be used during the coming spring and summer by Prof Peabody and his colleagues for original research. It is confidently expected that results will be obtained which will clear up certain obscure places in the theoretical work and design of the students of the department. The training received by the experimenters in the use of the equipment will thus form a part of the laboratory equipment of the department.

In photographic practice it is necessary to regard as capable of affecting a photographic plate all substances which, at the maximum temperature and humidity occurring in practice, produce hydrogen peroxide with sufficient rapidity to cause a perceptible deposit of silver on a plate exposed to their influence during one week. It is well known that most oxidizing agents produce hydrogen dioxide from gaseous oxygen in the presence of moisture. Aluminium, magnesium, and zinc, even at distances of 1/10 and 1/5 inch from the plate, produce a perceptible reduction of silver in two days. Consequently these metals should not be employed in the construction of cameras or plate holders, unless they are very thoroughly lacquered. A piece of newspaper, which has lain in the sun five minutes, affects a plate within 24 hours sufficiently to cause blackening on development. The action of hydrogen dioxide in increasing quantities on photographic emulsions is represented by a curve similar to that which represents the action of light. Paper treated with potassium permanganate affords a complete protection against the action of hydrogen dioxide, as the dioxide is decomposed by the manganese oxide which is formed on the paper.

The perennial debate on Martian canals will probably never be settled. Before the British Astronomical Association various more or less well-known astronomers gave their views. Mr. E. A. [illegible] some pictures taken at Mount Wilson by Prof. [illegible] on which no trace of the canals appeared. Mr. E. W. Maunder, whose attitude toward Martian canals is well known, again attacked the [illegible] advancing in evidence the [illegible] agrees with Maunder that the [illegible] by the [illegible]

ENGINEERING.

The North German Lloyd liner "Prinz Friedrich Wilhelm" has had an accident to its steering gear.

The N. Y. C. & H. R. R. R. announced early in 1910 that electric motor power will be used as far north as North White Plains. The delay at Wakefield now made necessary by the change from electricity to steam will be done away with.

The State Commission of Highways of New York has asked for an appropriation of $80,000 to be used by the Commission in developing experiments in economical forms of road construction which would be suitable to various weights and classes of traffic.

The Public Service Commission of the State of New York for the First District, will soon open bids for 87.77 miles of rapid transit lines. The sooner work can be begun on these subways the sooner will the terrible congestion be done away with.

A German machine manufacturer has invented a new means of power transmission by the use of steel wire. It is claimed that the system is equal in every way to leather belts, steel bands, chains, etc., and is much cheaper The wires are thin, and endless.

Sir Wilfrid Laurier, the Premier of the Dominion of Canada, has launched a bill which calls for the expenditure of $16,000,000 for a Canadian navy of 11 ships. The present indications are that it will carry 5 protected cruisers and 6 destroyers, to be built in Canada.

A special Board of Fire Control has been named by the Secretary of the Navy, to look into the question of the value of the military mast which has been installed on battleships, and report whether other masts of the same type should be placed on other vessels of the fleet

Since introducing the "Pay Within" cars in Philadelphia the number of accidents to persons has decreased 74 per cent. This is attributed to the arrangement of the closed doors and steps, making it impossible for passengers to get on or off when the cars are moving

We regret to note the death of Dr. Charles B. Dudley, consulting chemist of the Pennsylvania Railroad and president of the American Society for Testing Materials and of the International Society for Testing Materials. His contribution to the railway world was a most important one.

The total length of the new Manhattan bridge connecting the boroughs of Manhattan and Brooklyn is 6,855 feet. The total cost of the bridge, including real estate, is $15,833,600 The weight of the cables is 6,300 tons. There is provision for four trolley and four elevated tracks, one 35-foot roadway, and two 11-foot promenades.

During the remainder of the winter season vessels of the Cunard Line will steam directly to Fishguard, omitting the call at Queenstown. Since inaugurating this new port of call more than 2,000 passengers have made use of the facilities which have been provided, and have expressed themselves as being well pleased with the saving of time which is effected by cutting out the trip to Liverpool

Bids are being asked for the seats and frames of the Stoney gate valves to be embedded in the masonry of the twin locks at Pedro Miguel, and the upper twin locks and the spillway at Gatun, on the Panama Canal. Each valve is designed to operate in a well traveling on two roller train bearings with a span of ten feet from center to center, fastened to the down-stream face of the wall casing Each valve closes an opening 5 feet wide by 18 feet high.

The delay of passenger trains is often caused by a too slow method of admitting the passengers to the trains when the train platform is often crowded. Where tickets have to be examined, and passengers admitted one by one, there is always more or less delay. This can be avoided by a second series of gates. The examination of tickets is made at the first gate, which is then opened in ample time prior to the departure of the train. The passengers are then held behind the second gates until the train arrives or is ready to depart, when a number of gates can be thrown open and the passengers can at once proceed to take their trains.

The N. Y. C. R. R. Co. has asked the up-State Public Service Commission to re-open the investigation which led to an order regarding the use of oil-burning locomotives in the Adirondack forests during certain months of the year. The company says that it has complied strictly with the requirements of the Commission, but finds that the oil fuel is much more expensive than coal, while there is a much greater tendency to fuel failures, necessitating more frequent [illegible]

ELECTRICAL.

The question of using low-tension metal filament lamps is receiving considerable attention abroad. Transformers are being made for this particular purpose, which are fitted with interrupters, so that they may be used on direct current lines. It has been suggested to fit each lamp with a transformer The filament of the lamp could be a closed circuit, forming the secondary of the transformer

A simple method of clarifying the air of a room has recently been suggested. It consists of an electric fan or ventilator, which is operated in a cylinder, and from a reservoir above the fan a liquid is allowed to drop on the fan blades. This is thrown out against the cylinder in a spray, through which the air drawn by the ventilator must pass This serves to collect the dust from the air The inventor of this system proposed the use of glycerine or soapsuds, but it has been found that practically as good results can be obtained by the use of water

A novel method of catching fish was described in a recent issue of the Electrical Review and Western Electrician. A trolley line running between Franklin and Columbus, Ind, skirts the White River for a considerable distance, and it has been discovered that the trolley wire is frequently tapped to furnish current for fishing by electricity An end of the wire is placed in the water, and the current stuns such fishes as come within its influence, so that they can be taken out with scoop nets The trolley company and the Indiana Fish and Game Warden are trying to break up this method of fishing

The following estimate of the value of various electrical industries in the country during 1909 has been published in the Electrical World

Electrical apparatus	$275,000,000
Electric railways	475,000,000
Central stations	250,000,000
Telephony	250 000,000
Telegraphy	60,000,000
Isolated plant supply	75,000,000
Miscellaneous	50,000 000
Total	$1,435,000,000

The value of aluminium for the field coils of railway motors has been tested in Germany It is found that the aluminium takes up less space than the copper, although a larger mass of metal is required, because no covering is required The oxide film on the aluminium provides sufficient insulation and there is no danger of destroying or weakening this insulation by charring as in the case of the cotton covering when the motor is overheated so that there is less danger of short circuits. The principal advantage, however, is in the reduced weight, as the aluminium coils weigh but half as much as the copper coils.

A writer in La Revue Electrique describes the experiments of Miroslaw Kernbaum to determine the effect of ultraviolet light on liquids. He subjected about half an ounce of water to the rays of a quartz mercury vapor lamp, and after about ten hours gas appeared to be forming. At the end of two hundred hours 260 cubic millimeters (0 016 cubic inch) of gas was produced. The gas proved to be hydrogen, while the water showed that it was charged with oxygen This experiment explains the presence of oxygenated water in snow and rain It is proposed to use this method for sterilizing liquids, as oxygenated water is an excellent germicide.

Now, that aerial navigation is coming to be considered seriously new problems are arising, such as the question of navigation on starless nights or over fog bound land, when the aeronaut will be unable to find his bearings. It has been proposed by a German inventor that a network of wireless stations be established over the land, each automatically sending out a predetermined signal at regular intervals, which would be received by the air craft, and enable the aeronaut to determine his course The airships would not be required to carry transmitting apparatus, as a small receiving apparatus would suffice to enable them to avail themselves of this proposed system, and the weight of the receiving device could easily be kept down to a few pounds.

A new method of determining the sag of overhead wires has been suggested by a writer in the Elektrotechnische Zeitschrift. The pendulum principle is employed. The sagging wire is set to swinging, and the number of oscillations per minute is noted (the complete motion back and forth being considered, according to European practice, as made up of two oscillations). Letting N stand for the number of oscillations, the sag in centimeters is determined by dividing 447,300 by N^2 To find the sag in inches, divide 176,169 by N^2. Of course, this formula would apply to any distance between poles and any weight or quality of wire, because like the pendulum the period of the oscillation is determined only by the vertical distance between the center of gravity and the ends of support of the swinging wire.

SCIENCE.

Prof. E. E. Barnard of Yerkes Observatory has succeeded in obtaining a photograph of Halley's comet which shows a faint slender straight tail So far as is known, this is the first photograph to show the tail of the present returning comet.

A new estimate of the earth's age has recently been given by Prof William Morris Davis of Harvard For the usually accepted one hundred million years he estimates sixty million, based on an examination of the cliffs in Arizona and Utah where the time taken to deposit the strata can be easily computed

One objection to glass roofs is that if they are not very steeply inclined, the water of condensation collects on their under surface, and instead of running down along the separating ribs of the panes or plates, and being led off, drips upon persons or objects below, which is inconvenient and may be very expensive Even where the panes or strips are short, the path to the trough is too long The increase in length and width of the plates now used makes this difficulty of more and more importance each year One way of getting around it is, however, similar to that employed in forests and parks to prevent washing away of the hillside paths, namely, making inclined grooves toward the sides, only in this case the grooves are of horseshoe shape, and form a series of parallel corrugations which carry the drops to the ribs which separate the plate, they then follow these without much difficulty down the slant to the trough below This system may be employed either with glass sheets in which wire is embedded or with plain plates.

We notice in a recent number of the Medical Record a letter from Dr Robert L Watkins, New York city, in which he claims the credit of having applied the moving picture to the microscope. He states that as far back as 1897 he demonstrated the machine to a private audience, among whom was the Editor of the SCIENTIFIC AMERICAN The machine, known as the "micromotoscope," was described in our issue of July 31st, 1897 Later, microscopic moving pictures were exhibited at the Grand Central Palace during the Trained Nurses' and Pure Food Exhibition, the pictures thrown on the screen exhibiting the circulation of the blood in the web of a frog's foot, rotifers in stagnant water, an amœboid leucocyte, typhoid fever germs, and many others. Since that time Dr Watkins has greatly improved his rough apparatus, and gave a demonstration on June 17th last at Chicago before an audience of five hundred physicians of the National Eclectic Association We may venture to point out that Dr Comandon employs not the ordinary mircroscope, but the ultra microscope

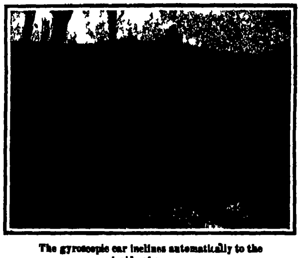
The third paper dealing with the results of the Smithsonian African expedition under Col Theodore Roosevelt has just been issued by the Smithsonian Institution It describes a new species of *Octocyon* to which the specific name of *virgatus* is given This new animal is a small carnivorous mammal closely resembling a fox It is generally buff in color, and it has been found by Mr Gerrit Miller of the museum staff to differ slightly from *Octocyon megalotis*, which occurs farther south, especially in color and in the characteristics of its teeth and skull The octocyon is peculiar to Africa, and is not represented in the United States, but resembles in color the swift or kit fox of the western plains The skull of this new form closely resembles that of the gray fox of our native fauna. This announcement is of special interest for the reason that comparatively few new forms were expected from this region in Africa as the territory up to this time explored by the Smithsonian African expedition has been pretty thoroughly examined by British naturalists.

The water bottle for getting water for analysis from selected depths in the ocean is a cylinder of brass, German silver, or other metal which resists the corrosion of sea water, generally about two inches in diameter and twelve or fourteen inches long, with upward-opening valves at the top and bottom, connected together on a central stem Lugs are cast on the side of the cylinder for conveniently securing it at any point along the length of the line by which it is to be lowered into the sea During the lowering of the line the valves of the bottle are kept unseated by the passage of the water through the cylinder during its descent, but, when the motion is reversed, the valves seat themselves and are locked by the descent of a small propeller in the framework above the upper valve, which rides idly on a sleeve during the lowering of the bottle, but descends along a screw thread to press the valves upon their seats when the line commences to be hauled up. A specimen of the water at the depth to which the water bottle has descended is thus brought to the surface confined within the bottle, and a series of specimens from different depths may be obtained at one haul by securing a series of water bottles at the required intervals along the sounding line.

THE SCHERL GYROSCOPIC MONORAIL CAR

THE PRINCIPLE OF ITS OPERATION

Within the past few months Mr Brennan has exhibited at London a car whi h runs upon a single rail and is prevented from fall ng over to either side by the resistan e of two gyros o|es carr ed on the car At about the same ime Mr S herl a German capitalist exhibited in Berlin a similar ar B tl cars were of sufficient size to a commoda e passengers both car



The gyroscopic car inclines automatically to the inside of a curve

ried their loads successfully and in ea h ase the gyroscopes maintained the car in a state of equilibri im—and they did this even when all tl e load was placed to one side of the car or when the car was running around a urve

Apparently the inventors worked quite independently of each other and it is a remarkable fact that in the essential elements for the control of the gyroscopic mechanism they should have produced machines so broadly identical The G rman car whicl is now being exhibited in this city represents the joint labors of Mr 1a l Froeli h the inventor who worked out the theory and data for the design Mr Emil Falcke who designed and constructed the car and Mr Scherl the owner of the patents

THE GYROSCOPE.—The simple gyroscope consists of a flywheel so mounted upon a system of bearings that its axis may be tilted in any direction The pe uliar and most interesting behavior of the gyroscope is due to tle fact that wh n a flywheel so mounted is rotating in a given plane it resists any effort to change its plane of rotation by til ing the axis on which it is turning Th tendency of the flywheel to maintain its plane of rota ion and i s resistance to any force tending to til it out of that plane is proportional to its momentum and since momentum in reases di rectly as the weight and as the square of the velocity it is cus tomary to use as small a weight and as high a velocity as possible Hence the fly wheels used in the Scherl car weigh only 125 pounds each but they rotate at the enormous speed of 8000 revolutions per minute We are all familiar with the gyroscope of the toy shops or the lecture room—the first mounted rotatably in one the second in two encompassing rings with the axes of the rings at right angles to each other and the flywheel axis in each case capable of universal angular motion In the accompanying engraving we show a gyroscope mounted as in the Scherl car The flywheel is carried on a vertical axis which is mounted in a gimbal ring This ring swings on a horizontal axis in bearings carried on two vertical posts mounted on a board which, for the present purpose we will consider to represent the deck of the car If we change the plane of rotation of the flywheel by pressing down on one side and tilting it over toward *B* two things will happen The board will resist the downward pressure on that side and tend to rise and the flywheel will be suddenly tilted over as shown in the direction *D* in a plane at right angles to the plane in which we have depressed the board

This tilting of the axis is known as its precession If now we endeavor to increase the precession by pressing down upon the already tilted axis the latter will resist v ry strongly and there will be developed at the same time a large additional resistance to our depression of the side *B* of the board It is in this advancement of the pre ssion as Brennan alls it though the precession be ause of he vigorous resistance of the fly wheel axis is not actually advanced) that the secret of the successful gyroscopic car lies as will be evident from the following des ription of the onstruction and operation of the Scherl car

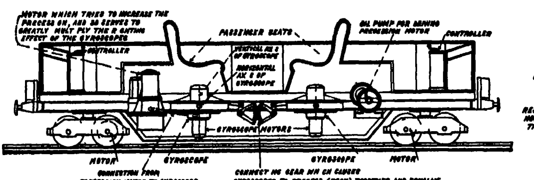
Referring to the engraving showing a longitudinal section it will be seen that the car which is 4 feet wide by 18 feet long is carried on two 2 wheeled swivelli g trucks |laced centrally below the longitudinal axis of the car It is driven by two ¾ horse power motors one on ea h truck At each end is a controller and a box containing various operating switches In the center are two seats accommodating four passengers

Mounted in the car frame underneath the seats are two gyroscopes one of which rotates lockwise the other anti-clockwise The flywheels rotate normally in a horizontal plane on vertical axes On the lower end of each axis is mounted an electric motor The axes are jo irnaled in strong steel airtight casings which completely inclose both motors and flywheels and the gyroscopes run in a perfect vacuum—this to avoid the skin friction of the air which would retard the speed. The casings are mounted on transverse axes journaled in the frame of the car and they are therefore free to rock in a fore-and-aft direction The clearance between the motor and the casing is so small that the heat of the motors can jump the insulating gap and radiate away freely and "heating up" is thereby avoided The speed of rotation of the 125-pound fly wheels as we have stated above, is 8000 per minute.

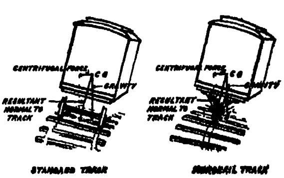
With three men on one side, car tilts to opposite side, restoring equilibrium

The rocking of the gyroscopes is in opposite directions—if the car is tilted to one side they rock toward each other and *vice versa* and to insure simultaneous and equal movement they are connected together by bell crank levers and two toothed quadrants as shown in the drawing In front of the gyroscopes is an electrically driven oil pump for generating hydraulic pressure to drive a precession motor which is carried at the rear of the gyroscopes The precession motor consists of a cylinder and piston controlled by suitable valves These valves are themselves operated by the rocking movements of the gyroscopes and the movements of the piston are caused through suitable mechanical connections to exert a tilting pull or push, as the case may be against the gyroscope

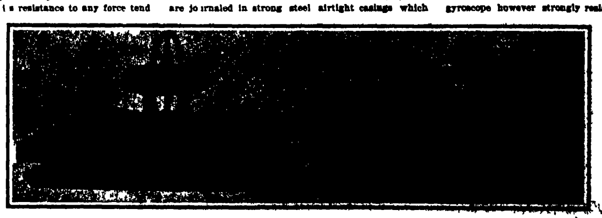
The functioning of this most ingenious mechanism is as follows When the car tips or tends to tip to one side there is an immediate resistance tending to right the car accompanied by a precession (tilting) of the gyroscopes This natural precession actuates the valves of the precession motor which in turn tilts or attempts to tilt the gyroscope still further on its traverse axis and so increase the precession The gyroscope however strongly resists and there is a resulting reaction transversely to the car tending to right the latter so that the righting effect due to the "natural" precession is greatly augmented by the "mechanical precession" attempted by the motor.



Longitudinal secti n thr ugh Scherl gyrostatic car



Old an l new method of rounding curves.



If the table (representing platform of car) be tilted transversely the gyroscopic flywheel will tilt fore or aft according to the direction of its rotation, and there will be developed a strong resistance to the movement of the table. This fore-and-aft movement is called the precession.

View showing gyroscopic movements.

THE SCHERL GYROSCOPIC MONORAIL CAR.

sult of all the forces pulling through the single rail on which the car runs.

One of our illustrations shows the Scherl car with three people standing on the side step, and it will be noticed that instead of the car inclining toward the loaded side, it actually inclines away from it. This, however, is in agreement with the facts observed in our consideration of the gyroscope, where the pressure on one side was immediately resisted by a counteracting force, causing that side of the gyroscope to rise. In the unloaded condition of the car the gyroscopes were holding it in a state of equilibrium with the center of gravity vertical above the rail. When the three people stepped upon the car the center of gravity moved over correspondingly until it was several inches outside of the rail causing the car to lean to that side. Immediately the gyroscopes began to pull the car over to the left until the center of gravity of the car and the three people was directly above the rail and equilibrium was restored. So sensitive and intelligent, if we may use the term, is the relationship between the gyroscope and its precession motor that they begin to act immediately upon the disturbance of equilibrium, they exert just the right amount of corrective force; and they become quiescent the moment equilibrium is restored.

Another of our photographic views shows the striking phenomenon of a car running around a curve upon a single rail and inclining inwardly to the proper degree to maintain its equilibrium. To practical railroad men this is certainly the most attractive feature of the invention, for it would mean the elimination of all the difficult, contradictory and expensive problems connected with the super-elevation of the outside rail on the present two-rail tracks. It is a fact that the car is so intelligent (we cannot help using the term) that whether the curve be easy or sharp and whether the car rounds it at ten or seventy five miles an hour it will lean inwardly with mathematical certainty to the exact amount required by its speed and the sharpness of the curve.

In the standard system of track the component of centrifugal force tending to hurl the car over to the outside of the curve or cause it to jump the track is equalized by elevating the outside rail until the resultant of gravity and centrifugal force falls normally to the track. This condition can only hold true on any given curve for a certain speed. Below that speed a train will grind on the lower rail; above it will crowd against the outer rail. Not so with the gyroscopic car. As soon as it enters a curve the pull of centrifugal force is resisted and the gyroscopes draw the car over to the inside of the rail until the resultant of all the forces acting upon it passes through the rail.

The gyroscopic car as above described is one of the most brilliant inventions of this or any age. But is it practical and will it pay? A discussion of this question will be found in our editorial columns.

THE DEATH OF LEON DELAGRANGE

After making a wonderful new record of 124 miles in 2 hours and 32 minutes on December 30th with a Bleriot monoplane, Leon Delagrange, who with Henry Farman was the first aviator to make flights with the crude Voisin biplane in France in the spring of 1907, met his death by a fall with the same monoplane on January 4th while flying at Bordeaux. Our photograph shows M. Bleriot with Delagrange standing at his left and Le Blanc, another daring pilot of the Bleriot machine, at his right. Behind the three men stands the machine which is like that Bleriot used in crossing the Channel and which Delagrange used on the day of the accident. A rather strong wind was blowing, and according to cable reports, when the machine headed into the wind the right wing suddenly broke and the monoplane fell to the ground. This is the first accident which has occurred owing to the collapse of an aeroplane when in the air. We understand, however, that some time ago a similar accident happened to Latham, but without disastrous results. One wing of his Antoinette monoplane broke off and stood almost at right angles to the other wing, yet by leaning to one side and warping the remaining wing, Latham was able to guide his machine down in circles and bring it safely to the ground. After repairing the wing he attached it in such a

Le Blanc Bleriot Delagrange

BLERIOT AND HIS TWO PILOTS IN FRONT OF HIS NO. 11 TYPE MONOPLANE.

way that when he was up in the air he could pull a cord and cause the wing to break off as before. He did this and came down a second time with the wing broken simply to demonstrate that a broken wing did not necessarily mean disaster. In the Antoinette machine the wings are secured separately to a mast so that the breaking of one does not affect the other. In the Bleriot monoplane the wings are connected together over a tripod, the result being that if one breaks the other collapses and the machine is sure to be dashed to the ground.

The death of Delagrange will put a damper upon the ardor of some enthusiasts for a time, but it was due to one of those unfortunate accidents which are always liable to occur in the development of a new art. His name will go down to history as one of the martyrs of aerial navigation. He is the fourth aviator to be killed within the past four months, the others being Lefebvre (who plunged to earth in his Wright machine), Capt. Ferber (who struck the ground when making a turn in his Voisin) and the Spanish tailor Fernandez (whose small biplane resembling the Curtiss broke while he was making one of his first flights on December 6th last). All four fatal accidents occurred in France.

A NEW ENGLISH TRIPLANE.

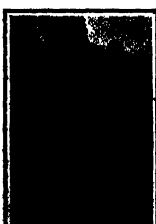
One of our illustrations shows the new triplane of Mr. A. V. Roe. Mr. Roe is one of the most persistent English experimenters. He has been working a long time and has finally developed a successful machine. His triplane is really a Langley type machine in triplicate, since it has three superposed surfaces forming a tail and attached like the forward planes to a triangular body. The motor is mounted in the body at the front end of the machine and drives a three bladed propeller mounted upon its crankshaft. The aviator sits in the body about half way between the main planes and the following planes or tail. The machine is mounted upon two wheels at the front and a skid at the rear. It is 23 feet long and the planes have a spread of 20 feet and 320 square feet of supporting surface. They are set at an angle of five degrees. The forward planes are 20 feet by 3 feet 7 inches, while the rear planes are 10 feet by 3 feet 7 inches in size. The total weight of the machine originally with a 10 horse-power Jap motor was but 400 pounds. A larger motor of 20 horse-power has been fitted. The weight has been considerably increased. The body is made of deal wood. It is covered with cotton oil paper backed with muslin. The machine is steered up and down by changing the inclination of the main planes, which are pivoted so they can be turned. There is a vertical rudder at the rear. The machine is steered by working this rudder and at the same time twisting the rear edges of the main planes.

Mr. Roe has done most of his experimenting at Wembley Park, and recently the grounds have been enlarged there so as to give him more room. He has made a considerable number of short flights in a straight line, and his machine is remarkable for its low power, light weight and small spread.

AVIATORS' COSTUMES AND A MACHINE FOR TEACHING BEGINNERS.

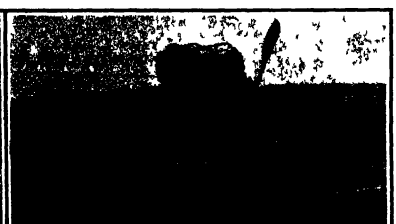
Two of the photographs reproduced on this page give a very good idea of the costumes worn by French aviators and of the dress soon to be adopted in France by the lady operators or aviatresses. The costumes used by the men consist of overalls and jumper and a tight fitting skull cap completely covering the head. The costume being used by the lady operators consists of a loose blouse and long bloomers extending to the tops of the shoes. A skull cap similar to that used by the men is also worn. At the present time but two ladies have made flights by themselves in aeroplanes in France. These are the Baroness de la Roche, who operates a Voisin biplane and who recently met with an accident by running into a tree, and Mlle. Marvingt, who is the first woman in the world to have flown a monoplane. She has made several successful flights with a Hanriot machine. A number of other ladies are learning, however, and several aviation clubs have been formed for women. One of the most recently organized of these was formed at Los Angeles, Cal.

Another interesting picture at the bottom of this page shows a novel training machine for accustoming aviators to a monoplane of the Santos Dumont type. This machine consists of a substantial triangular body mounted upon three wheels and terminating in a tail having movable vertical and horizontal surfaces by which the machine is steered to right and left when running along on the ground or by which the tail is made to rise a short distance in the air. The two bottom members of the triangular frame are extended forward and meet above a small wheel five or six feet ahead of the main wheels, so that if the machine tips forward when the tail rises the front wheel keeps it from tipping too far. A four-cylinder water-cooled motor of 40 horse-power is mounted upon a U shaped frame and carries a propeller in front on its crank shaft. The would-be aviator sits in a small seat below the motor with the control levers conveniently at hand. The machine is fitted with large wire wheels fitted with large diameter pneumatic tires. With this machine a beginner can travel at very fast speed over the ground and accustom himself to the steering sideways and up and down of a monoplane. The machine should serve a useful purpose in training aviators who intend to fly this type of aeroplane.



French [illegible] costume.

Roe's triplane in flight.



Machine for familiarizing beginners with an aeroplane.

A NEW ENGLISH TRIPLANE AND A FRENCH MACHINE FOR TEACHING NEW AVIATORS.

A POWER-DRIVEN SAW.

The continuously running flexible saw is by no means a novelty to our readers.* Its leading principles are embodied in the band saws now in common use. Although effective for sawing lumber band saws are incapable of cross-cut sawing on large trees in the forest because the band necessarily runs in two planes For the purpose of overcoming this objection Mr R L Muir has perfected a new style of endless cross-cut saw which is flexible in a single plane of motion and which is carried in a frame which with the idle side of the saw follows the saw-cut through the log the frame being sufficiently stiff and rigid to keep the saw in perfect line

The frame in question 1 is made of thin steel with grooved edges Projecting brackets 2 and 5 are bolted to the ends In the brackets guide wheels 3 and 4 with grooved peripheries are journaled The bracket 5 has a handle by which the operator controls the saw An endless chain composed of saw links 6 is mounted on the guide wheels and runs on the straight edges of the frame The guide wheels on the frame serve to keep the chain straight during operation This frame and the toothed chain constitute an endless saw which runs continuously and which makes a single saw cut in the plane of its motion The saw moreover is adapted to all kinds and styles of sawing for which either circular saws band saws or mechanically driven reciprocating saws can be used and for which hand saws are ordinarily employed the two handled cross cut saw being a familiar example

The chain saw is driven by a gasoline or electric motor the inner guide wheel being geared up with the motor shaft as indicated in our front page illustration The motor is carried on a skid which skid is moved along on ways whenever a new cut is to be made

Mr Muir has carried on extensive trials with the saw in the vast redwood belts of Mendocino and Humboldt Counties in California with remarkable success The most important advantage of his construction is that of the speed One of his large saws it is asserted will cut through a tree having a diameter of some five to seven feet in less than ten minutes By the old and slow hand process this same work would consume an hour and a half with two men wielding the saw One of the machine saws will accomplish as much as from 25 to 30 expert sawyers a wonderful saving in time and expense when it is considered that only two or three men are needed to operate a machine The saws can be run horizontally vertically or on an incline Trees can be sawed within a few inches of the ground—a great saving thus being effected in stump waste In felling trees of immense size by the slow chopping methods hundreds of feet of valuable timber are lost by chippage because it is often necessary to cut up as high as eight feet above the level of the stump The mechanical saw described avoids much of this waste

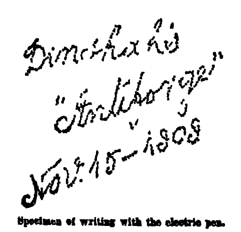
AN ELECTRIC PERFORATING PEN

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

Though various efforts have been made from time to time to evolve an electrical system of securing an indelible writing record which is complete proof against both forgery and fraud such devices have proved commercially impracticable A Parsee inventor however Dr Dinshah P Ghadiali has evolved a simple apparatus which is very efficient It is called the antiforge pen which as its name implies is to render forgery impossible The writing is made up of a series of perforations burned in the paper The apparatus comprises a small box with a sloping lid measuring about 20 inches long by some 16 inches wide The whole of the electrical equipment is carried within the box or desk the lid of which is glazed and carries at its upper end a sheet of aluminium The pen itself is of the ordinary stylographic type

The requisite current is drawn from a small [illegible] ampere storage battery as shown at A in one of the illustrations The battery is connected up in the usual manner to an induction coil B to which is fitted a small high-speed trembler capable of adjustment by a thumb-screw on the outside of the desk Between the secondary terminals of the coil a small cylindrical condenser C is placed in order to increase the intensity and fatness of the spark

In an electric system of writing care must be taken to prevent the inside of such letters as *o d e* and so forth from dropping out which would result if the outline were continuous This possibility is obviated by means of the trembler coil which makes the current rapidly intermittent At the same time however such rapidly succeeding waves of electrical energy rising up to 10 000 volts instantly followed by a drop to zero, impose a severe strain upon the induction coil, and will in time seriously affect it. To guard against such a result the inventor has introduced a novel device which may be best described as a safety valve to the coil This is a highly exhausted vacuum tube, D which is also placed between the secondary terminals and which is in parallel with the pen E This etheric buffer" or vacuum tube acts as a ballast load upon the coil, and any resistance which may be offered to the passage of the electric current through the pen is taken up thereby causing it to glow brilliantly At the same time it also acts as a galvanometer as before writing the operator simply presses the pen point against the desk, and the resultant glow in the vacuum



Specimen of writing with the electric pen.

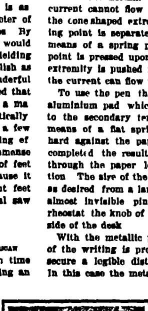
tube indicates that the apparatus is working efficiently

The pen is about the same length as the ordinary fountain pen and its barrel contains a mercury break The connection with the coil is effected by a short length of flexible wire carried on a spring barrel By means of the mercury break contained in the barrel the primary circuit is never closed until the pen is held in the normal writing position Even then the current cannot flow to the point of the pen because the cone shaped extremity carrying the metallic writing point is separated from the barrel connection by means of a spring piston It is only when the pen point is pressed upon the paper wherein the metallic extremity is pushed inward against the mercury that the current can flow to the pen point

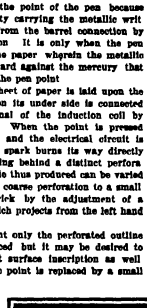
To use the pen the sheet of paper is laid upon the aluminium pad which on its under side is connected to the secondary terminal of the induction coil by means of a flat spring When the point is pressed hard against the paper and the electrical circuit is completed the resultant spark burns its way directly through the paper leaving behind a distinct perforation The size of the hole thus produced can be varied as desired from a large coarse perforation to a small almost invisible pin prick by the adjustment of a rheostat the knob of which projects from the left hand side of the desk

With the metallic point only the perforated outline of the writing is produced but it may be desired to secure a legible distinct surface inscription as well In this case the metallic point is replaced by a small length of graphite—that taken from an ordinary lead pencil acts excellently Then in writing one secures a visible surface record and when held up to the light a perforated record may also be seen In order to obviate the necessity of holding the paper to the light to see if the perforating is being efficiently effected, there is a small metallic filament lamp and reflector fitted inside the desk and by pushing a button on the left hand side the writer can ascertain the results by examining the writing in the light transmitted through the glass desk lid

By this method of writing it is impossible to produce two signatures exactly alike, even if written by the same person. The [illegible] is [illegible] in its path through the paper [illegible] the line of least resistance, and the perforation is consequently irregular instead of occurring at regular intervals. The [illegible] prepared paper contains infinitesimal obstructions, and these the electric spark avoids. The result is that the operator cannot even produce an exact facsimile of his own handwriting, though each is absolutely correct. This peculiarity is a distinct advantage when it is required to sign a number of sheets of a document, a bond and its duplicate, a will and its copy, for instead of signing each sheet separately the papers are simply superimposed and the top sheet written upon The current will burn its way through the whole mass of papers so that the signature is written simultaneously on each and in perfect duplication. Consequently it is absolutely impossible fraudulently to withdraw one sheet and insert another with a signature, for it is only a matter of counting the number of dots or perforation marks in the signature on each sheet, and that which differs from the rest is obviously spurious As many as eight sheets can be perforated by the pen at a time



The 'desk" open, showing the coil and accessories.



The inventor using the perforating pen.

AN ELECTRIC PERFORATING PEN

The Payroll of the Navy.

To provide for the welfare and comfort of the officers and enlisted men of the navy during the fiscal year of 1911 it is going to cost Uncle Sam just $5 767,477 Of this amount over 35 000 000 will be spent to buy food for the 46 499 enlisted men. The Navy Department figures that it costs the government $168 a year to feed each man, or just $9 a month The payroll of the enlisted men in the navy during 1911 will aggregate nearly $18 000,000 This sum will take care of 41 723 in the general service 454 men in the insular force and 1 156 prisoners under sentence by court martial

About one-fourth of the men serving in the navy today have re-enlisted Of the 43 323 allowed by law 11 681 men are estimated as under re-enlistment and entitled to participate in the allowances for re-enlistment and continuous service These figures do not take into consideration the 3 000 or more apprentices. Based on the men in the service in June last the average pay of the enlisted men was $35 73 a month.

The perquisites allowed officers in the navy will aggregate nearly three-quarters of a million dollars in 1911 Of this amount $144 449 will be spent in providing heat and light The heaviest cost in the allowance granted the naval officers in addition to their pay is in the matter of quarters for those who can not be accommodated in buildings or houses maintained by the government. The commutation of quarters will aggregate $435 780 while the commutation of rations figured at 30 cents a day will reach a total of $165 456

An Electric Plant Operated by an Air Turbine.

Near Hamburg Germany is a small electric establishment concerning which the following interesting details have been published The installation comprises 400 incandescent lamps and five electric motors, which drive a threshing machine a hay cutter a cream separator and two pumps. The total capacity is 40 kilowatts. The Hercules turbine has a wheel 40 feet in diameter mounted on top of a steel tower about 100 feet high The apparatus begins to work as soon as the wind attains a velocity of 10 or 13 feet per second In this region a wind of this force can be counted on for 10 hours a day on the average With a wind of 26 feet per second the power developed is 30 horse-power or 23 kilowatts. The installation also includes storage batteries and a gasoline motor for use in calms. The turbine operates so satisfactorily that it was unnecessary to use the gasoline motor during a period of 90 consecutive days. The storage battery of 60 elements, has a total capacity of 495 ampere hours, and furnishes a current of 165 amperes for three hours. The first cost of the establishment, including the gasoline motor, was about $4,000, while the plant which it replaced and which was operated entirely by a gasoline motor, cost only $3,000 On the other hand, the annual cost of operation of the electric plant is only $1 100, while that of the old plant was $1,700

The work of extending the electric zone of the New York Central Railroad as far as North White Plains is proceeding quite rapidly, and it is expected that by the first day of next year it will be in full operation. The temporary terminals at Wakefield, where steam and electric locomotives are interchanged, will then be abandoned. A new substation is being erected at Tuckahoe and another one at White Plains. Both will be equipped with three 1,000-kilowatt rotary converters and nine [illegible] transformers of [illegible] watts capacity.

Correspondence.

A MATHEMATICAL QUERY

To the Editor of the SCIENTIFIC AMERICAN

If your correspondent in the issue of November 27th will study the following figures, he will plainly see that it is impossible to get 35 sets of 3 out of 1 15 so that no two numbers will be in the same set more than once.

1 2 3	1 6 11	1 7 13	1 8 15	1 9 12	1 10 14	
4 5 6	2 7 12	2 8 14	2 9 11	2 10 13	2 6 15	
7 8 9	3 8 13	3 9 15	3 10 12	3 6 14	3 7 11	
10 11 12	4 9 14	4 10 11	4 6 13	4 7 15	4 8 12	
13 14 15	5 10 15	5 6 12	5 7 14	5 8 11	5 9 13	

Brooklyn N Y JOHN WEHNAU

LOCALIZING GASOLINE EXPLOSION

To the Editor of the SCIENTIFIC AMERICAN

The recent explosion of a gasoline tank on an automobile and also one in this vicinity of an autoboat both attended with fatalities has suggested to my mind a facile means of rendering these explosions harmless. A number of years ago I was reading a description of a powder factory and one of the means used to minimize danger was in the construction of magazines. In order to localize the effect of explosions, the warehouses and some of the factories were built on the edge of a river The five sides not abutting on the river were made extraordinarily strong while the side fronting and opening on the river was made correspondingly weak. As forces seek the avenue of least resistance the houses so constructed were analogous to a gun barrel the explosion was localized and its force expended more or less harmlessly over the face of the stream How easy then to see a gasoline explosion rendered innocuous to the occupants of a motor vehicle Simply by making the reservoir analogous to a gun barrel Constructing the back and barrel of the gasoline reservoir in cylindrical form of boiler plate say ¼ inch thick the rear end pointing in the clear, toward the rear of the vehicle The explosion then is similar to that of a rifle or shotgun and is directed harmlessly away from the occupants The rear end may have valve seat bearing and be clamped in with a spring to resist ordinary wear vibration and pressure but yielding harmlessly to explosive force Thus an explosion of gasoline in the reservoir need cost no more than a recharge of that volatile spirit, and the labor of reclamping the rear end G OC McMANIS

Houston Tex

CONTINUOUS BISECTION OF A MILE

To the Editor of the SCIENTIFIC AMERICAN

We all know that the middle and western portions of this country are laid out in mile-square sections which can be continuously bisected to form homesteads of 160 acres and then smaller lots whose size and location can be briefly and accurately described

The last whole number that we reach by subdivision in this manner in feet is 165 and this would form the sides of a square whose area would be 100 square rods.

Continuing the bisection of this 165 feet through inches and fractions thereof we presently reach the length of 30.9375 inches which approximates to the U S military step by 0.0625 inch an amount inappreciable in actual measurement by pacing Now this length of pace is that of the standard axe helve measured from the inside of the bit to the end of the handle. It is the length of the average human arm and reminds one of the South American *vara* of 32 or 34 inches which also probably had its origin in the length of a pace. Being squared it will divide evenly of course into any of the above-mentioned divisions of land and the periphery of such square is ¼ inch less than that of the standard wagon bed of the middle west, which is coming more into use as a measure of capacity If we make a cube of this dimension the contents of four such cubes would project above the sides of such wagon bed 1/10 inch an amount which would require careful measurement to detect One such cube, filled with water would hold close to one cubic foot of water more than the one-half ton of 1,000 pounds, and would divide into the cubic meter 1.06 times.

But a remarkably close approximation to our standard measures of capacity is found in further twice bisecting this length of 30.9375 inches. We find thus a length of 7.73 + inches, which, cubed as before approximates the capacity of two of our standard liquid gallons within two-thirds of a cubic inch.

While approximations useful to the military man [illegible] the farmer for rough and limited [illegible] [illegible] simple statutory [illegible] in the metric [illegible] yet [illegible] There is no [illegible] [illegible]

"quarter" hour instead of so many dimes or so many minutes, "half" ton or "half" pound instead of so many pounds or ounces. Observe too that it (continuous bisection) is the method we use in deriving all of our lower measures of volume

Guthrie Okla. JOHN M BISHOP

SIGHTING A RIFLE.

To the Editor of the SCIENTIFIC AMERICAN

Every marksman is familiar with the effect of raising or lowering the rear sight on his rifle Perhaps not so commonly understood is the effect of raising or lowering both front and rear sights simultaneously

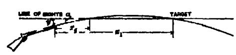
On point-blank range the target front and rear sights lie in the same straight line when the gun is correctly pointed The trajectory of the bullet is a curve intersecting this straight line in two points one of which is the center of the target It therefore follows that if a rifle is correctly sighted for one range there is another range for which it is equally correct and it is the purpose of this article to show how these two points may be located at will by correctly arranging the elevation of both front and rear sights

The most accurate shooting is done with 0.22-caliber rifles at ranges of from 25 to 50 yards and when once the sights are correctly set for one range no marksman likes to change them It may therefore be of interest to know how they may be set for correct work at two ranges which may be a considerable distance apart

The path of a projectile *in vacuo* is a parabola and since air resistance may be neglected for very short ranges and low velocities the parabola equation will be correct enough for our purposes The equation is usually stated thus

$$y = x\tan a - \frac{g x^2}{2v^2\cos^2 a}$$

y is the distance from the line of sights to the center of the gun barrel x the range g the acceleration of gravitation and a the angle between the line of sights and the center line of the gun barrel The relation of those quantities is all shown in exaggerated detail in the diagram



Since the angle a will be quite small for short ranges we may replace $\cos a$ with unity which is practically its equivalent thus simplifying the equation This gives us

$$y = x\tan a - 16.1\frac{x^2}{v^2}$$

Taking data from a Winchester 0.22 rifle equipped with globe sights and sighted for 75 feet we have $y = 9/16$ inch $= 0.0468$ feet $v = 1\,000$ feet per second

$$\text{Thus}\quad 0.0468 = x\tan a - \frac{16.1\,x^2}{1\,000^2}$$

Reducing to the form $x^2 + \frac{b}{a}x + \frac{c}{a} = 0$ in which the product of the roots equals the third term we have

$$x^2 - \left(\frac{1\,000^2}{16.1}\tan a\right)x + \frac{1\,000^2}{16.1}\,0.0468 = 0 \qquad (4)$$

Calling the roots x and x_1, $x\,x_1 = \frac{1\,000^2}{16.1}\,0.0468$

$$x = 75\text{ feet}\quad 75\,x_1 = \frac{1\,000^2}{16.1}\,0.0468\quad x_1 = 39\text{ feet}$$

Thus when one range is 75 feet the other is 39 feet which is too close to be of any use We see also that the 75-foot range is on the falling side of the curve so that a little greater distance will land the bullet below the mark.

To bring x_1 on the farther side of x, it is evidently necessary that y must be increased or in other words both the front and rear sights of the rifle must be elevated

We will now find the value of y so that the gun will shoot correctly at both 75 and 150 feet As before

$$x^2 - \left(\frac{1000^2}{16.1}\tan a\right)x + \frac{1000^2}{16.1}y = 0 \qquad (5)$$

Taking the product of the roots equal to the third term $75\;150 = \frac{1\,000^2}{16.1}y$ $y = 0.181$ feet $= 2.17$ inches

Thus by setting the front sight 2.17 inches above the center of the bore and elevating the rear sight till the gun shoots correctly at 75 feet it will be found also correct at 150 feet. Moreover it may be shown that at any range between 75 and 150 feet will the error be more than 2.4 inches The angle of elevation of the sights may also be determined from the equation but it is much easier to get this angle right by means of trial shots, as it is very small and difficult to measure Its determination is as follows In equation (5) the sum of the roots equals the coefficient of x with its sign changed Thus $75 + 150 = 225 = \frac{1\,000^2}{16.1}\tan a$

$\tan a = 0.00362$ $a = 12$ min. 27 sec

Of course all the above results are based on the assumption that the velocity is 1 000 feet per second which is about correct for a 0.22 short cartridge Below is given a table in which the values of y are worked out for other velocities and ranges

Air resistance which causes the projectile to depart from a parabolic path will have the general effect of causing the tabular values of y to be too low but this effect is not very noticeable for the short ranges and low velocities which are common in 0.22 caliber marksmanship

The results are not intended to apply to high power rifles and long ranges although the departure of the projectile from a parabolic path does not alter the fact that any rifle may be correctly sighted for any two ranges within its limit

Velocity in Feet per Second	Height in inches of front sight above center of gun barrel for different combinations of ranges in feet						
	50 75	50 100	50 200	50 300	75 150	75 200	75-300
900	0 695	1 19	2 88	3 [illegible]	2 65	3 59	5 [illegible]
1000	0 795	0 965	96	3 [illegible]	2 1	3 00	4 [illegible]
1100	0 60	0 [illegible]	1 [illegible]	2 4	[illegible]	2 4	3 [illegible]
1200	0 [illegible]	[illegible]	1 35	[illegible]	51	2 01	3 [illegible]
1300	0 45	[illegible] 5	1 14	1 [illegible]	1 [illegible]	1 [illegible]	2 57
1400	0 [illegible]	0 4	0 985	1 48	1	1 48	2 [illegible]
1500	0 38	0 45	85	1 29	9	1 [illegible]	1 94

Warren O WILLIAM C WOODLAND

The Light of the Firefly

After referring to the original work of Profs Langley and Berry and describing accurately their methods of investigation Dr H E Ives and W W Coblentz draw from their own investigations the following very interesting conclusion as to the relative efficiencies of the light of the firefly and that of incandescent electric lamps

The efficiency of the light of the carbon filament lamp is 0.43 per cent In other words of all the energy used only 0.43 per cent is converted into light The tungsten lamp has an efficiency of 1.3 per cent and the mercury arc 3.8 per cent The efficiency of the light of the firefly is 96 per cent Making the comparison in another form the carbon filament lamp has an efficiency of 83 watts per mean hemispherical candle the tungsten lamp 1.6 per candle and the metallic arc 0.6 watt per candle In comparison with these the firefly has an efficiency of 0.02 watts per candle

The Current Supplement

The current SUPPLEMENT No 1777 opens with an interesting article by the English correspondent of the SCIENTIFIC AMERICAN on the Madras Harbor Works which include a north breakwater arm 1 000 feet long to protect a new entrance E A Allcut writes on producer gas for engine fuel While means of illumination have been developing and the organized systems of distribution have ramified throughout the community there has been another and very different development going on via the growth of a branch of the science of optics which deals with the measurements of luminous values and which has been embodied in what is now called illuminating engineering Dr A D Rockwell writes on the incandescent and arc light in medicine Cartagena de Indias as it was termed by the ancient governments and now spoken of in Colombia as The Heroic City has more of the tragic and melodramatic in her history than any other town on the western continent The story of this community is told by Isaac A Manning The year 1909 marked the three hundredth anniversary of the invention of the telescope the occasion is fittingly described by Prof J L E Dreyer in an excellent article on the history of the invention of the telescope Mr Charles Richards Dodge contributes a brief article on forest destruction by insects versus forest fires

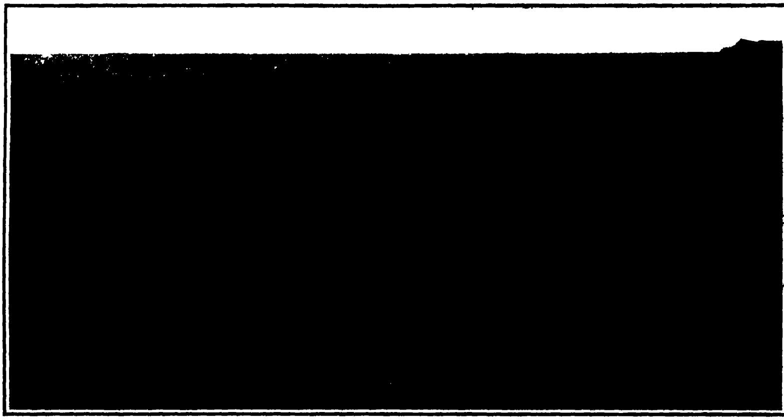
The Battle River Viaduct of the Grand Trunk Pacific Railway 677½ miles west of Winnipeg completed in December 1908 is a steel plate girder viaduct 2,712 feet long between abutments and 184 feet high from base of rail to low water or about 139 feet average height above ground It comprises a 150-foot deck truss span crossing the main part of the river channel one 70-foot plate girder span and fifty-one 50-foot plate girder spans resting on twenty-six steel towers Thus the tower spans are of equal length with the intermediate spans, i e 50 feet The substructure is of concrete the two river piers and most of the land footings being founded on piles

THE NEW NAVAL HARBOR AT DOVER

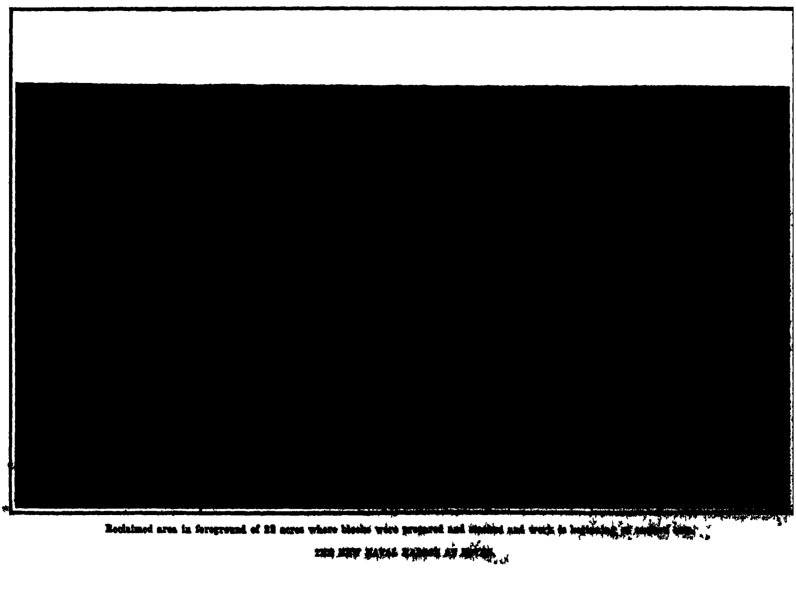
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

The harbor facilities of the British Admiralty have been greatly extended by the recent completion of the new and extensive works at Dover at a cost of some $*0 000 000 Dover is a point of considerable strategical importance and the necessity of some refuge for war vessels in its vicinity was advocated some hundreds of years ago Unfortunately however its geographical situation is such that it is exposed to all seas between extreme east and extreme west the full fury of which appears to be concentrated or at any rate is experienced thereat There was no convenient headland or other natural barriers of which advantage could be taken so that to convert the port into a harbor of refuge easily accessible in all weathers and which would be completely safe necessitated elaborate development works

It was in 1895 that the government decided to convert the port into a national harbor with a low water area of 610 acres, by the construction of a protection arm on the eastern side of the slight bay projecting 2 942 feet into the sea the reclamation of 3 900 feet of foreshore at the base of the cliffs the extension of the existing Admiralty pier used by the vessels engaged in the cross channel traffic with France and an island breakwater between the two extremities of the land arms 4 214 feet in length The general design of the works may be gathered from the accompanying plan



General view of the harbor from the east



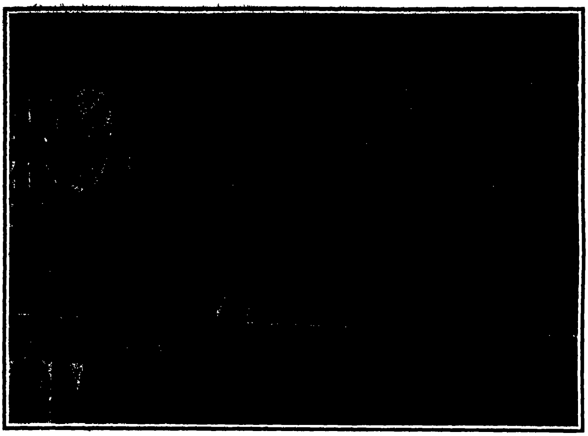
Reclaimed area in foreground of 22 acres where blocks were prepared and [illegible] and work in [illegible]

THE NEW NAVAL HARBOR AT DOVER

in which the new construction is indicated by the sections indicated in full black. It will thus be seen that an aggregate length of 11 154 feet or over two miles of breakwater has been constructed. Access to the anchorage is secured by a gap between the western extremity of the sea arm and the Admiralty pier 740 feet in width and on the eastern side by another gap 650 feet in width. By this means the harbor can be entered in any weather, tidal circulation is promoted and silting up within the inclosed area prevented. The arrangements provide for a water depth at the entrances ranging from 40 to 43 feet at low spring tides and as these tides rise nearly 19 feet it will be seen that at high spring tides the water depth is about 60 feet. Within the harbor itself a water depth at low tide up to 40 feet is available thus meeting the requirements of the largest war vessels. The contract for the undertaking was placed in 1897 with Messrs. S. Pearson & Sons, Ltd., of London, to whose courtesy we are indebted for the accompanying illustrations.

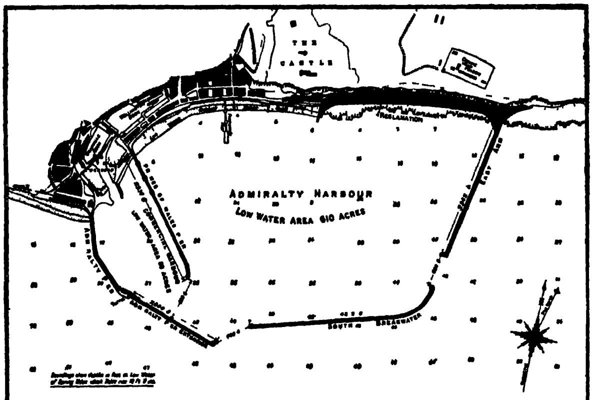
The surveys showed that the sea bed consisted of chalk, chalk marl and flints, so that a solid foundation could be secured for the masonry work. The work is carried out in solid masonry, the blocks ranging from 26 to 40 tons in weight and composed of 6 to 1 concrete. A large block making yard was established as soon as possible upon the area reclaimed from the sea, and here two 45 ton gantry cranes for handling the blocks were erected. The material for the concrete was drawn from suitable points a few miles distant and a funicular railway was built to the top of the cliff for bringing the material down to the electrically operated Messent concrete mixers, which, while the mixing operation was in progress, traveled along an elevated track above the molds and dumped their contents where and as required. In all 260 000 tons of Portland cement was consumed in the preparation of 1 300 000 cubic yards of concrete.

Actual construction was carried out from elaborate heavy timber staging, the piles of which in some cases exceeded 100 feet in length. This staging was carried to a height of 46¼ feet above low water and the deck was provided with tracks for the manipulation of the various constructional appliances. These latter comprised Goliath cranes ranging from 40 to 60 tons capacity and with a radius of 100 feet. Four of these cranes were used simultaneously on the stag

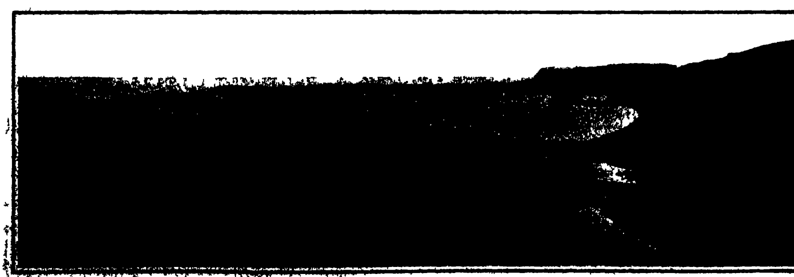


At extreme left, grab for clearing foundations; at right, diving bell ready to descend. At rear, cranes for setting blocks below the water level.

Staging at the pierhead works.



Plan of the Dover harbor works. New structure shown in full black.



Complete view of Dover Bay and Harbor

THE NEW NAVAL HARBOR AT DOVER.

ing. The subaqueous work was accomplished by means of diving bells Most of these had an internal measurement of 17½ feet by 10 feet and 6½ feet headroom with a weight of 35 tons when out of water and about 5 tons when submerged. They were fitted with telephonic communication and were provided with electric lighting The sea bed was first cleared by means of the grab excavators to within about 12 inches of the requisite level Then the diving bell descended and the men within completed the work and excavated to about 3 feet below the level for the foundations of the superstructure Owing to the severity of the scour and tidal action the foot of the breakwater on its outer face is protected by a masonry apron about 25 feet in width built up of concrete blocks ranging from 9 to 14 tons in weight and 3 feet 6 inches deep The bed for the apron was excavated to a depth of 2 feet by divers From foundation level up to low water the blocks are bonded together by varying the length of the blocks and are doweled in the vertical joints with 4 to 1 concrete sausage dowels of circular section Above low water the courses are bedded and grouted in 2 to 1 cement mortar while the outside blocks above this point are faced with granite the stones being well bonded into the concrete matrix

The reclaimed area lies at the foot of the cliffs and has a length of 2 300 feet by a maximum width of 350 feet the space being some 22 acres On this expanse it is intended to erect the various buildings required for repairs stores and so forth as well as two protected reservoirs for the storage of gasoline for submarines a station and depot for which is to be established her The eastern arm projects seaward from the eastern extremity of this reclaimed area in a southerly direction for 2 942 feet The construction of this southern breakwater was among the most difficult of the whole under taking owing to its exposed position and the great depth of water The average depth on this section of the foundations below low spring tides was about 47 feet the greatest depth being 53 feet Work was commenced in August 1904 and by December of the same year 430 feet of foundations was completed and the masonry brought up to the level of low water When the extension on the western pier had been completed and the plant there used was transferred to the island section work was maintained at a much higher pressure 2 000 feet of foundations being completed in a year while in two months alone 1 14 blocks were set in position

The width of the structures at foundation level ranges between 52 and 77 feet In the case of the eastern arm the width at deck level is 47½ feet while that of the southern breakwater is 40 feet and the Admiralty pier extension 45 feet In all cases the height of the deck level above high water spring tides is the same viz 10 feet

The extension of the existing Admiralty pier was commenced in August 1899 This arm was to be doubled in length that is to 4 000 feet and in this case owing to the existence of a revolving gun turret on the old pier head which it was decided to retain the pier had to be widened for a distance of some 680 feet in order to permit the railroad tracks serving the steam ship berths to be laid

Both the western and eastern piers are provided with a parapet 11 feet and 10 feet wide respectively the top of the former being 41½ and that of the latter 39 feet above low water The deck of the south breakwater however is quite level though similar provision can here be made if and when desired

The works have given employment to from 1 500 to 1 800 men and consid ring its character the accidents and fatalities have been insignificant No deaths or permanent injuries were recorded in connection with working in compressed air either in the diving bells or diving dresses During construction several exciting incidents occurred While the south breakwater was under construction the liner "Deutschland ran into it seriously damaging its stem and removing a mass of masonry As a result several blocks had to be removed and reset To carry out this work an ingenious hydraulic ram was especially evolved comprising a horizontal cylinder having vertical rams capable of exerting a lift of 150 tons by means of which the blocks were lifted so as to be gripped by the Goliath cranes and then reset. On another occasion a vessel while entering the harbor fouled the timber staging. The collision was so violent that the two outermost cranes were carried away and considerable damage inflicted Severe delays occurred through gales. In consequence of the exposed character of the position, the full force of the southwesterly and easterly storms was experienced the waves sweeping over the works. Owing to the elaborate precautions adopted however no valuable plant was lost though at times the heavy staging showed striking evidences of the battering by wind and wave It may be mentioned that the quantity of water required during an ordinary spring tide and which flows through the two entrances is 17 000 000 tons

A NOVEL BOILER AND FURNACE CONSTRUCTION

The furnace and boiler illustrated in the accompanying engravings possess many decidedly novel features which nevertheless have proved efficient in practice The grate of the furnace is curved up at each side of the boiler so that the forward part of the boiler is half submerged in the fuel which comes in direct contact with the boiler shell The fire burns its way up through the coal which as it is consumed feeds downward from opposite sides of the boiler while there is a downward draft through the coal which carries the gases to the bottom of the furnace and here they combine with air that passes through admissions at each side of the ash pit and flows between the grate bars up through the incandescent fuel The burning gases then flow through a narrow neck into a corrugated flue of large diameter which conducts them to the rear end of the boiler after which they pass through the boiler tubes to the stack Great care is taken to proportion the stack to the surface area of the tubes and flue so that the highly heated gases will pass slowly through the boiler and deliver the maximum number of heat units for the generation of steam The side grates of the furnace are provided with rocking bars which may be operated individually but they are preferably connected to a single shaft as shown in the illustration by which they may be operated all at once either by hand or mechanically to shake the coal downward toward the bottom of the grate The lowermost part of the grate is provided with a section which may be reciprocated lengthwise when shaking down the fire Ordinarily the fuel tends to feed itself down the side grates and it is merely necessary to supply it with sufficient coal at the top The fuel is thoroughly dried as it progresses downward so that there is little chance for the production of smoke despite the fact that the inner wall of the furnace consists of the water cooled boiler shell Most of the draft supplied to the furnace enters the side admissions of the ash pit which are provided with dampers to regulate the intake of air

In the spring of 1907 one of these boilers was installed in a factory at Dover N J to take the place of two boilers of 50 and 60 horse-power respectively The new boiler on the usual rating of grate area to the tube and flue area should have generated about 74 horse-power but under test it was found to develop 98 5 horse-power Formerly a stack 126 feet high was required but with a new boiler the stack was reduced to one extending but 25 feet above the boiler The boiler was 6 feet in diameter and 11½ feet long, containing 84 4-inch tubes The neck of the main flue was 9 inches wide and 54 inches long, while the flue was 27 inches in diameter.

This boiler has been in use constantly ever since and we are informed that it is giving entire satisfaction The principal claims for it are, that it requires less fuel and less attention than heretofore, while combustion is almost smokeless. Since the first installation at Dover a number of these boilers have been installed in this vicinity and appear to be doing good service.

Front elevation and longitudinal section showing the curved grate and interior details of the boiler.

A NOVEL BOILER AND FURNACE CONSTRUCTION

A Novel Balloon Gas.

At the recent Congress of German Aeronauts at Frankfort on the Main, Dr W von Oechelhaeuser presented a preliminary communication on the results of experiments made in conjunction with the German Continental Gas Company toward the production of a new balloon gas These show the decomposition of ordinary coal gas in vertical retorts to yield in normal operation a balloon gas of a specific weight of about 0 235 so that about one kilogramme would be the lifting power of one cubic meter According to the Statutes and Regulations of the International Association of Aeronauts the buoyancy of one cubic meter of street gas has so far been calculated at 0 700 kilogramme and that of hydrogen gas at 1 050 kilogramme It is true that in connection with certain hydrogen plants a gas of a lifting power of 1 185 kilogramme is said to have been obtained and that the official figure of 0 700 kilogramme would be too low for a number of gas works, corresponding to too great a specific gravity viz. 0.44 During the Gordon Bennett ascents at Berlin a gas of 0 4 specific weight was used However on the basis of the official international figures above stated the lifting power of the new balloon gas would bear a ratio of 1 000/1 050 to the lifting power of hydrogen This would mean that a balloon of a capacity of 1 000 cubic meters would be able to lift 300 kilogrammes more than a balloon of the same capacity filled with coal gas, or else the size of a balloon with the same lifting power could be reduced by 30 per cent.

This balloon gas contains upward of 80 per cent of hydrogen while the content of methane which was the most difficult to decompose is reduced 5 to 7 per cent. The gas has only a very slight odor which is likely to prove very convenient to passengers in the case of free balloons with open charging tubes. Furthermore it contains neither benzol nor any other heavy hydrocarbon capable of attacking the balloon cover The theoretical fact that coal gas is decomposed by great heat which is underlying the process has long been known and seems to have been first discovered by Bunte about forty years ago However the difficulties so far experienced in utilizing this reaction for the production of a light gas on an industrial scale proved far greater than had been supposed The most important point was to produce this gas during the ordinary operation of the gas works and in the same retorts in which the ordinary coal gas is generated The inventor therefore used the vertical retorts of the Dessau gas works He is now engaged in experiments intended to ascertain whether the process is adaptable also to horizontal retorts and other types

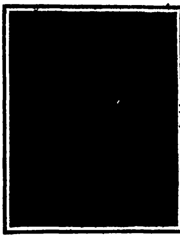
The Washington Aqueduct after forty-six years of service is in excellent condition according to the last annual report of Major Jay J Morrow, of the United States Corps of Engineers This aqueduct crosses 26 valleys on 4 bridges and 22 embankments containing culverts. The only signs of deterioration were found, it is reported in unlined portions of the conduit where a small quantity of rock had fallen from the roof and side walls. It was noted that the mortar in the brick masonry in the lined sections although inferior to present-day Portland cement, had not been washed out of joints to any great extent. Recent experiments showed that 90 000,000 gallons per day is about the maximum carrying capacity of the aqueduct.

According to the Railroad Age Gazette, the [illegible] Railway which recently equipped thirty [illegible] locomotives to burn oil, has been unable to [illegible] supply of this fuel, and has had [illegible] converted into coal burners. The oil [illegible] failed to carry out his contract, [illegible] expense of the [illegible].

CURIOSITIES OF SCIENCE AND INVENTION

[illegible] METHOD OF CARRYING AN UNCONSCIOUS PERSON

A new method of carrying persons who are unconscious, injured, or otherwise incapacitated is being used by the New York Fire Department. Ordinarily the unconscious man is turned face downward and then lifted up on his knees after which he is placed across the fireman s shoulder The new method consists of throwing the burden across the back over both shoulders, instead of one as heretofore The right thigh and right upper arm of the man that is being carried are gripped between the fireman s arms and body close to the armpits This leaves the fireman s forearms and both legs free Formerly the fireman had the use of but one hand and arm making it a dif ficult matter to carry a victim down a scaling ladder With the new method the weight of the burden is supported in a position where a maximum load can be carried with minimum exertion The one that is rescued is firmly locked on the fireman s shoulders by the powerful muscles of the shoulders and upper arms. With both forearms and hands free the fireman can carry a burden down a vertical ladder without danger of falling and can even slide down the ladder after a little practice To Dr Charles H Duncan whose work at one of the emergency hospitals of this city has brought him into contact with firemen and others injured at fires the New York Fire Department is indebted for this new and practical method of carrying an unconscious person



CARRYING THE MAN DOWN A SCALING LADDER.

LIFTING THE MAN ONTO THE BACK AND SHOULDERS

EXPERT CHAIN WHITTLING

For several years I have been collecting specimens of expert jackknife whittling Among those who have contributed specimens is Mr George W Lockwood Long Ridge Conn. About two years ago he supplied some specimens of chain whittling from a broom stick that were far above the ordinary For a time I regarded them as the best in existence A little later I obtained some triple chains from a Philadel phia expert that slightly excelled those by Mr Lock wood whose attention was called to the Philadelphia work Mr Lockwood determined to go him one bet ter" and the results were the two chains and orna ments shown herewith These are by far better than any others I have been able to obtain Each chain is from a piece of wood of broomstick shape the cutting is without break and done with an ordinary jack knife. The 'nested hourglass sections are especially intricate and skillfully done The inner glasses turn readily in sets or sections As will be readily seen the links are symmetrically shaped and well finished

'How long did it take you to make them?' I in quired

"Time? Oh don t mention it I didn t dare keep any record —Edward F Bigelow

A VACUUM CLEANER FOR CLEANING STREETS.

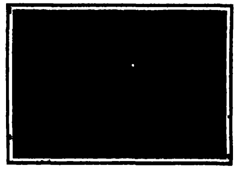
The war against dust which is now so successfully waged in houses by means of vacuum cleaning ma chines should undoubtedly be extended to in lude street cleaning It is just as important to keep the dust down when sweeping streets and more so because street dust is always heavily laden with disease germs which are a constant menace to passersby and par ticularly to the street sweepers A ma hine has just been perfected whi h works somewhat on be rin ciple of the smaller household vac um cleaners The dirt and refuse of the surface ov r whi h the machine travels is gathered by rotating brushes and then by pneumatic power is sucked or lifted into onduits where the heavier parts of the refuse are extra ted and deposited in closed receptacles The fine dust which it has been impossible for mechanical sweepers as heretofore devised to dispose of is carried onward in closed conduits and we ted down so that it may be taken off in the form of silt

The suction me hanism is operated by the engine whi h propels the mach ne tl e pow r f tl e exh st being utilized in the process of separating and re lu ing the d st

By actual tests recently made nder the n s ad verse onditions this sweeper has shown its ability to clean in an hour as much stre s rfa e as the old fashioned horse-drawn sweeper will sweep or brush in six hours

MOTOR AMBULANCE FOR DOGS.

A curious motor ambulance for dogs is to be seen in the west end of London This ambulance is the property of the Animals Hospital and is used for conveying dogs to and fro It resembles a Noah s

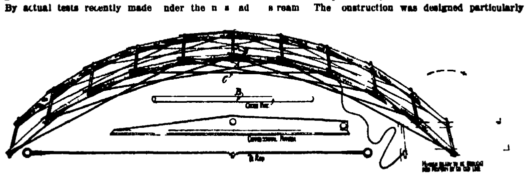


MOTOR AMBULANCE FOR DOGS.

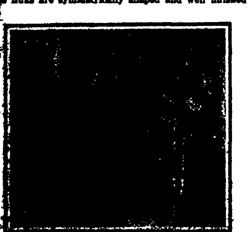
Ark in shape and is drawn by a 3 horse-power motor yc e to which it is atta hed by means of an ingenious coupling device which prevents the ambu lance overturning when raveling around corners The ambulan e is mounted on easy springs is fitted with pneumatic tires and is well padded inside in order to minimise vibration Being motor drawn it can do ong jo rneys expeditiously and ailing animals can be conveyed to the hospital and treated without delay

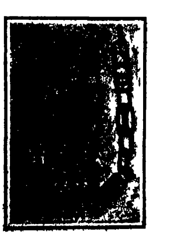
A NOVEL BRIDGE CONSTRUCTION

An emergen y bridge onstructio which appears to have o siderable meri was re ently exl ibited be fore the Britisl War ffi e It o nprises only three different ieces ill strated at *A* *B* and *C* in the accom panying sket h The art *A* is the compressional m n ber and is the only part whi h would have to be arried in st k Parts *B* co d be chopped out of tim ber gr w ng in the vi inity while he tie rods *C* could be for ned on tl e s o of rope r preferably wire The onstru tion of the b idge will be unders ood by re ferring o the me nbers shown i dotted lines at the right hand end of he bridge A rossbar which runs through th last compressional members of the bridge serves as a pivot for two more compressional m mbers that are cen ra y fulcrun ed hereon When the two ompressional me bers are swung around as indicated by the arrows the tie rod is drawn taut and serves to take its share of the load In building u a bridge of this sort the o ter end o ld be su ported on a boat or ont on while the engineers were adding the successive pairs of members to the shore end of the bridge until a suffi ient span was produced to rea h acr ss the s ream The onstruction was designed particularly for se in reinfor ing a on rete arch When used in this way the ompressional bars ould be placed at the utside and after the concrete l ad set they could be removed for use in building the next arch.

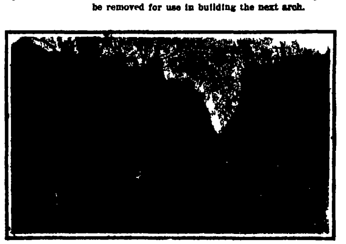


NOVEL TEMPORARY BRIDGE CONSTRUCTION





[illegible] OF CHAIN WHITTLING [illegible] "NESTED HOURGLASSES"



VACUUM CLEANER FOR CLEANING STREETS

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

NECKTIE-FASTENER AND COLLAR BUTTON.—T PAPWORTH, Portland, Ore The object of the inventor is to provide a combined necktie retainer and collar button, which can be easily inserted in and removed from a stiffly starched collar, and which in its preferred form effectually conceals the tie fastener The retainer and button is preferably made of a single flat piece of metal, although it may be produced by other means.

Of Interest to Farmers.

BALING PRESS.—I W ROHAM, JR. Lancaster Pa This is a powerful and simple press for tobacco and like material. It can be easily manipulated by one operator and the material to be compressed can be rapidly and easily formed into compact bales which permits twine or the like to be positioned therein to facilitate the binding of the bales, and there are special locking means for holding the folding sides in position

WIRE STRETCHER.—J B. DAVIS and F B. ADAMS, Wisner Neb This stretcher is arranged to permit properly stretching wire between posts or around a corner post, and to hold the stretched wire until it is fastened in place, and without danger of causing any slack between the post and stretcher, and to allow of readily splicing adjacent wires without the stretcher being in the way of the operator making the splice

SPRING TOOTH CULTIVATOR.—G G BRIDGEN, Cypress Ala This cultivator is of the type that presents cross bars to which the spring teeth or hoes are attached By adjusting the position of these bars the arrangement of the teeth can be changed as desired The adjusting mechanism will insure that the bars will hold themselves perfectly rigid in their different adjusted positions.

Of General Interest.

COAL-BASKET.—H G MITCHELL, New York, N Y The aim in this improvement is to produce a basket especially adapted to be formed of duck, canvas or similar stout fabric, and which is provided with a reinforcing frame giving the finished basket strength and durability for handling coal or the like Feet project below the bottom of the frame to receive the principal part of the wear across the earth or floor

ELECTRIC FURNACE FOR THE CONTINUOUS EXTRACTION OF ZINC FROM ITS ORES.—E F CÔTE and P R PIERRON, 24 Rue Sully, Lyon, France The object in this improvement in electric furnaces is to permit zinc ores, preferably poor blends, to be treated in a continuous manner for extracting the metal therefrom, and permitting the heating of crude blends without it being necessary to previously roast them in order to transform the sulfid into oxid.

STOPPERING FOR BOTTLES INTENDED TO CONTAIN VOLATILE LIQUIDS.—J BENGUE, 47 Rue Blanche, Paris, France This device enables a capillary orifice of larger diameter and the capillary orifice employed for delivering ethyl chlorid in medical practice to be stoppered. It may be utilized for ethyl chlorid or other volatile products either mixed or not with medicinal substances or with perfumery essences.

AREA FINDING APPARATUS.—ARTHUR C FREEMAN, Norfolk, Va. The invention comprises a flat steel plate that is magnetized and a number of soft iron balls. The drawing upon which the area is outlined is placed over the plate. The area outlined is then filled with the iron balls. The magnetized plate causes them to cling to the plate and to each other The balls are then taken out and placed in a measuring frame, and the number of square inches occupied by the balls is ascertained

EYE-SHADE J A BLACKSTOCK, Seattle, Wash The object of this invention is to provide a shade which will effectually prevent light rays from reaching the eyes, and it is especially adapted for use by people desiring to sleep in the daytime in order to obviate the necessity of darkening the room.

GASTROSCOPE. M SUSSMANN, Berlin, Germany This gastroscope comprises a horizontal and a vertical part. The latter when flexible is easily introduced through a feed pipe into the stomach, after which it is straightened for the examination This part can be turned through any angle After examination the vertical part is turned into its flexible state, so that it can be easily drawn out

Heating and Lighting.

ADJUSTABLE HANGER FOR LIGHTS.—H J HINDS Hillyard Wash The purpose of the inventor is to provide novel details of construction for an adjustable hanger that is particularly well adapted for the suspension of a lamp or the like from an overhead support, and enable the vertical adjustment of the light at a desired height

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 11, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Adjusting device, H D Chapman 946,060
Advertising device, automatic, B. C Ferguson 946,500
Agitator or mixing apparatus, R. Smith 946,281
Air brake apparatus N H Davis 945 758
Air compressor C G Simonds 946,068
Air drying apparatus, Reynolds & Norton 946,009
Alarm. See Burglar alarm
Ammonia, manufacturing, F W Frerichs 946,427
Amusement apparatus A Bragg 946,200
Anvil for steam hammers, A Kossel 945,796
Armor plate and other article of steel, F Giolitti 946,428
Ash receiving device, W. M Sharp 946 409
Augur, post hole, D W Looker 946,060
Automobile steering and motor controlling mechanism C Schmidt 946,465
Awning fixture J Sullivan 946,280
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Beer dispensing apparatus, W A Wentzell 946,477
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Berths curtain attachment for sleeping car, J W Winn 946 417
Bicycle frame, A Levedahl 946,142
Binder, loose leaf Copeland & Chatterson 945,916
Blacking case shoe A Rydquist 946,464
Blacking heated iron G H Johnson 945 954
Blade holder and sharpener, A A Ensminger 945 771
Boat, S C. Johnson 946 513
Bobbin machine single thread lace, E Kreusler 946,445
Boiler circulating device, F H Newhall 945 977
Boiler furnace, steam, C H Knowles 945 980
Boiler furnace, steam, T Reevers 946,525
Boiler superheater, steam, W Schmidt 946,466
Boiler water gage, T R. Cook 945 756
Bolt washer, screw G L. Hall 946,127
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Brake, R. R. Knowles 946,057
Breaking or granulating machine J H Spencer 946,268
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Brush, metallic, R. Henry 946 512
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Building block, O Brumbaugh 946,590
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Calender rollers, device for the automatic introduction of cloth between G. Girardt 946,439
Candle shade holder, G L. Lang 945 [illegible]
Cap, W Abrahams 946,[illegible]
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Car bolster, E. H. Benners 946,[illegible]
Car coupling, E. C. Washburn 946,176
Car fender, O J Schmitt 945,818
Car lining, freight, W J Brennan 946,747
Car passenger electric railway, F H Lincoln 945,984
Car replacer Coleman & Abrames 945 [illegible]
Car roofing, metallic, J T Crawford 945,918
Car seat, F Hachmann 946,135
Car underframe, O. T. Westlake 945,[illegible]
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Cars and other vehicles, fender for J A. Wiedersheim 946,180
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Caster roller, W Poet [illegible]
Catch, safety, J Stamm [illegible]
Cattle guard, A M. White [illegible]
Cement posts, wire fastener for, J. L. [illegible] 946,076
Centering device, J. R. Blew [illegible]
Centrifugal separator, L. K. Peter [illegible]
Centrifugal switch, J B. Wiard [illegible]
Check for hotels guest, H. Lesh [illegible]
Checks, slip clip for issuing bill, Rockfield & Tornquist 946,[illegible]
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Chute for directing water to current motors, portable, J. E. Bragler 946,106
Chute, grain, Mann & Plumtree 945,975
Cigarette case F J Palmer [illegible]
Circuit breaker, E. M. Hewlett [illegible]
Clamp, A. R. Pegler 946,[illegible]
Clock, secondary electric, T Mungall 946,[illegible]
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Commutator truing machine, O E. Hunt 945,784
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Composition of matter, R. D Powers 945,900
Concrete post or pole O Dougherty 946,348
Concrete walls, piers columns, etc sectional mold for forming J G Barnes 946,315
Concreter's belt H H Pugh 945,[illegible]
Condenser, F J Loomis 946,[illegible]
Condiment holder, H Wilson Jr 946,095
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Dough mixing apparatus, H H Wilson 946,300
Draft equalizer F M Smiley 946,405
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Drop feed lubricator F Lowry 946,450
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Dye black azo, O Gunther et al 945 780
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Dye brown M Kahn 946,051
Dynamometer, Park & Phillips 946,264
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Egg beater A C Poore 945,985
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Fence post, metallic, J W Altmyer [illegible]
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Filter, G. V Sponsenberger [illegible]
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Fire escape, W C. Baird [illegible]
Fire extinguisher systems, automatically released alarm bag for, J G Nolen [illegible]
Firearm, W. H. Gates [illegible]
Firearm guard or deflector, H. B. Febiger [illegible]
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Fish trap, J. P. Cleary [illegible]
Flat iron, J Courtenay [illegible]
Flower holder, A. Hohman [illegible]
Flue cutter, W. H. Damon [illegible]
Flushing device, F F Hawkins [illegible]
Folding chair J Hales [illegible]
Folding or collapsible box, case, and the like, D. Purdue [illegible]
Fowl, fastening feet and legs of F Somers [illegible]
Fruit gatherer, J. W. Howard [illegible]
Fulcrum block, Coe & Gallagher [illegible]
Furnace, A. [illegible]
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Furnaces, automatic draft regulator for, F. Wagner [illegible]
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Furnaces, rotary grate for, H. R. Waite [illegible]
Furniture clamp, J. W. [illegible]
Fuse block, electrical, Morris & Andrews [illegible]
Gage, W. A. Greavis [illegible]
Gambrel, automatic beef spreader, G. H. Bauer [illegible]
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Gas and coal furnace, combination, F Y. Parker [illegible]
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Gas fixture, A. Jarmolowsky [illegible]
Gas generator, acetylene, W. A. Ready [illegible]
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Gas mains, automatic cut-off for, C. R. Lakmers [illegible]
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Grader, road F A. Mattson [illegible]
Grain distributer, C. W. Camp [illegible]
Grain dump, E & F I Merritt [illegible]
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Grain, means for treating seed, G. E. Dantels [illegible]
Grate, J C Bartlett [illegible]
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Harvester, cotton, D. H Mays [illegible]
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Illumination system, C. P. Steinmetz [illegible]
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Indexing book C. H Drake [illegible]
Internal combustion engine, H H. Simons [illegible]
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Iron or steel, treatment of, W R. Hodgkinson [illegible]
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Keyboard operating mechanism, Knudsen & Barta [illegible]
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Lamps, apparatus for exhausting incandescent, F L. O Wadsworth [illegible]
Lamps, carbon feeding mechanism for arc, L. O Komar [illegible]
Lamps, obtaining metallic attachments for incandescent, P Asaris [illegible]
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Last, shoe A G. Long [illegible]
Latch, gate G S. Mitchell [illegible]
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Laundry iron, electric, R. H Richardson 946,070
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Locomotive ash pan, H A. Hoke [illegible]
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Looms, lay for narrow ware, W Wuttig [illegible]
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Paper bands apparatus for producing combination of holes in, E Ehrhardt 946,094
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Pie making machine D K Allison 946,082
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Power distribution system W J R Emmet 945,920
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Primary battery T W Byrne 946,008
Printing E Bossart 946,[illegible]
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Railway electric signaling apparatus W J Cook 946,[illegible]
Railway rail chair W F Gould 945,779
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Railway trains, automatic stopping mechanism for W J Wilgus 946,[illegible]
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Railways guard covering for third rails of electric J Krone 946,[illegible]
Range boiler V Wilhelmi 946,[illegible]
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Reamer expanding J G Matthews 946,[illegible]
Receivers, means for exhausting inclosed M von Recklinghausen 946,[illegible]
Receptacle metallic, C W Brown 946,[illegible]
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Reel machine reel, McLane & Sipp 946,076
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Relay or electromagnet electrical M E Clement 946,[illegible]
Resistance device, G Hookham 946,[illegible]
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Revolver automatic G Vander Haeghen 946,[illegible]
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Roof ornament A B Bowers 946,[illegible]
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Saw tool, C L Johnson 946,[illegible]
Sawdust conveyer J Clase 946,[illegible]
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Sawmill gearing E H Chandler 946,[illegible]
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Sewing machine cording attachment A F Day 945,780
Sewing machine embroidery or ornamental stitch W N Parkes 946,150
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Shaft support, J Eberwein 946,[illegible]
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Sharpening machine file C M Emerson 945,[illegible]
Shearing machines electrically controlled squaring mechanism for E Miles 946,487
Sheet manipulating device O S Beyer 946,100
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Smut machine Zeitler 945,[illegible]
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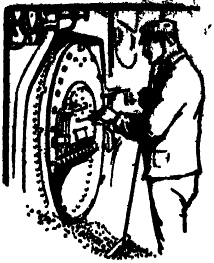

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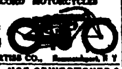

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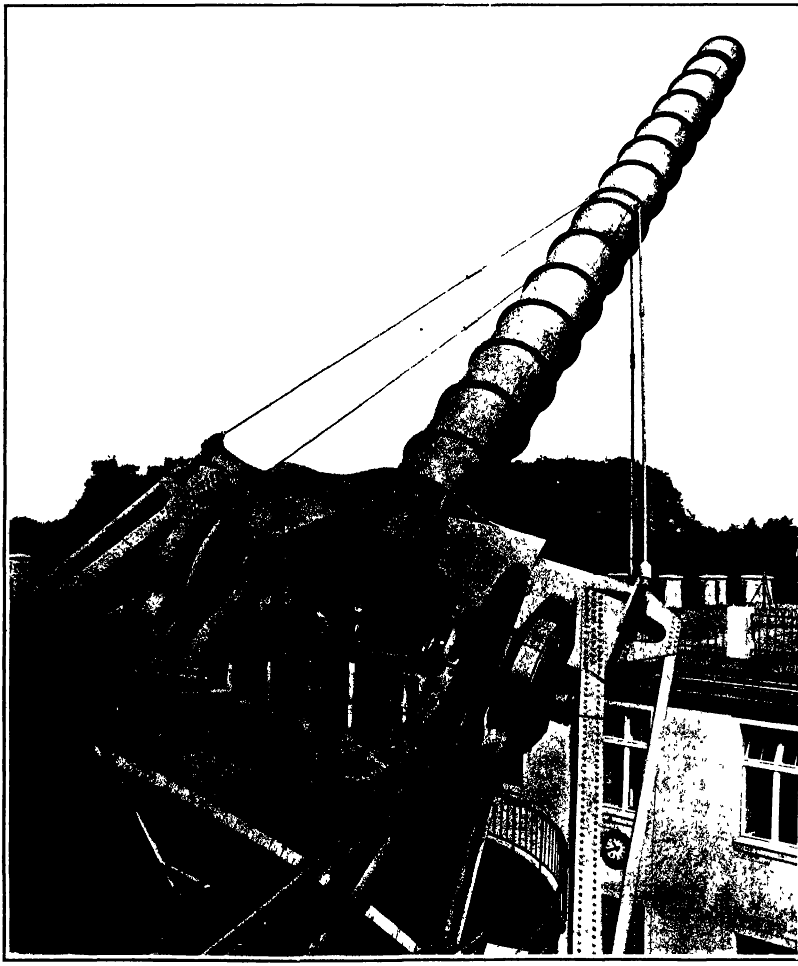

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short* and the facts *authentic* the contributions will receive special attention. Accepted articles will be paid for at regular space rates

WAVE VERSUS SHIP

WAS it a last despairing protest of Old Ocean, when he lifted his giant hand in the blackness of the night of January 10, and smote the 'Lusitania' a blow which racked and splintered her lofty bridge and pilot house, 75 feet above the sea and crushed down her forecastle deck and decks beneath, giving them a permanent depression of several inches? For time was, and not so very long ago, when the sea was the undisputed master of the ship, and whenever Neptune saw fit to open the vials of his wrath and send his league-long rollers across the deep the proudest ship of the day must needs stop at his bidding if she did not indeed turn and run before the fury of the blast Of late years, man, by virtue of his knowledge and mechanical skill, has been building in ever increasing lengths and breadths, and with such ceaseless enlargements of bunker and boiler room—he has so multiplied horse-power, and has called to his aid so many ingenious contrivances for speed and strength and safety, that old Neptune must for many a decade past have foreseen the humiliating day when he could no longer hold the destinies of the bold sea voyager in his hand, and no longer say to him Thus far, and thus slowly shalt thou go'

Following the hint of ultimate victory which was supplied by the "Lusitania' and 'Campania,' came that wonderful ship of the Hamburg American Line the "Deutschland," and the even larger and more powerful 'Kaiser Wilhelm" and "Cecilie' of the North German Lloyd, and with the advent of each giant vessel, man's growing mastery of the ocean was shown in ever increasing speed, and a closer approximation in times of departure and arrival to the regularity of transportation on land

It was reserved for the steam turbine to supply the last mechanical device which was to give to man in his age-long struggle with the elements a weapon of complete victory, for in the combination of size and strength and power afforded by the latest turbine liners there has been developed a ship which has demonstrated its ability to drive at full speed and all day long into the heaviest seas that the stormy North Atlantic could pile across her path The writer will not soon forget a notable day some two winters ago, when the 'Lusitania, in weather which varied from a gale to a full hurricane, averaged for the twenty four hours a speed of between twenty-six and twenty-seven land miles an hour During the tumult of that tremendous struggle ten ton anchors were shifted, it is true and steel derrick booms were swung athwartship and twisted as if they were no stouter than a boy's tin whistle Yet the ship steamed into port practically intact and with not a rivet started in the whole fabric of her hull

Ordinarily a transatlantic liner will drive her way against a westerly gale voyage after voyage, with no more serious hurt than the bending of a stanchion or the breaking of a pane of glass in the pilot house But once in a long while there may come a combination of seas which are so related to the length of the ship that she may be riding down one wave, with her bow buried deep and her forecastle deck awash just as her stem drives into a roller, steep of front and of vast height Then it is that the structure of the ship meets its moment of supreme trial and not even the officers 75 feet above water, are safe from the full impact of a solid Atlantic sea.

On the Monday night in question, because of the tempestuous weather, the glass windows in the pilot house had been lowered and the storm windows built of solid wood with a small heavy glass port light in the center, had been raised The stern of the vessel was lifting high on a receding sea, and the forecastle deck was awash, just at the moment that a wave of gigantic proportions loomed up at the bow. From the fact that the solid water swept entirely over the pilot house and the compass stand upon its roof, which latter is at least 80 feet above the normal waterline, this wave must have been some 35 feet high measured from the trough The sea was breaking and therefore the mass of water must have had considerable forward momentum The ship itself was running at half speed, and met the sea at a speed of from twelve to thirteen knots When the mass struck the breastworks and pilot house, every one of the stout wooden storm windows was burst in, the woodwork being stripped clean to the sashes, and the stout steel framing between the windows was forced several inches into the pilot house The sea swept onward, driving a piece of the woodwork bodily through a hardwood casing containing a portion of the fire-fighting apparatus The quartermaster was borne back against the bulkhead behind, carrying in his hands the wheel which was torn from its standard The mass of water then swept into the officers' ward-room and staterooms, filling them breast high with water—and this, be it remembered, at an elevation of 75 feet above the normal sea level

Now, since the ship is some 80 feet broad at this point, and the distance from the pilot house to the stem must be at least 150 feet, and since, in order to roll over the pilot house, the waves must have been some 35 feet in height, at least 4,000 tons of water must have swept over the forecastle deck—as anyone with a pencil and pad may easily figure out for himself It cannot be possible that the wave fell with much vertical impact, or the decks would have crumpled up like an eggshell, but the momentum was sufficient to crush the forecastle deck and the three decks below a few inches down into the body of the ship, leaving them with a permanent set Dramatic evidence of the enormous stresses to which the ship was subjected is afforded by the stanchions and solid steel bulkheads below the deck, which, in some places, buckled out of the vertical as they yielded beneath the load above Had the 'Lusitania" not been built of special strength to stand such buffeting as this, the results might easily have been very serious indeed, and we are inclined to agree with her captain in his belief that many smaller and less stoutly built ships, which have disappeared utterly at sea, may have been sent to the bottom by the crushing in of their decks under so-called tidal waves" of these dimensions

INDUSTRIAL FELLOWSHIPS IN UNIVERSITY WORK.

THE University of Kansas has inaugurated a system of Industrial Fellowships, which is based upon a broadly similar practice that has already been followed to some extent in Europe Some three years ago Prof Duncan of the Department of Industrial Chemistry directed the attention of manufacturers to the necessity for greater technical efficiency, and suggested that this might be promoted if the manufacturing interests in the field of industrial chemistry co-operated with the universities by establishing fellowships for research in certain specified directions. At the present time eleven fellowships have been established of which eight are now in operation A full discussion of the scheme will be found in the current issue of the SUPPLEMENT, but the general scope of the movement may be gathered from a consideration of the following fellowships which are among those which have been already established

A Fellowship for an investigation into the chemistry of laundering, with a view to saving laundered fabrics, $500 a year with 10 per cent of the profits.

An investigation into the Chemistry of Baking established by the National Master Bakers' Association, with the object not only of improving the chemistry of bread but of providing for the association of a trained expert on whom they could thereafter rely, $500 a year together with a sum to be settled by arbitration

An investigation into the relation between the optical properties of glass and its chemical constitution, $1,500 a year and 10 per cent of the profits.

The discovery of new utilities for ozone, $2,000 a year and 10 per cent of the profits.

The general form of the agreement calls for an investigation to which the holder of the fellowship gives his whole time and attention, with the exception of three hours a week which he devotes to work of instruction in the Chemical Department of the University The Fellow, who is appointed by the chancellor and other officers of the university, must have a reputation in research, must be a member of the university, must work under the direction and advice of the Professor of Industrial Chemistry, and must forward through him to the industrial company, the donors of the fellowship, periodical reports of the progress of his work All discoveries made by the fellow during the tenure of the fellowship become the property of the industrial company, subject to the payment to the fellow of 10 per cent of the net profits. In the event of any disagreement between the donors and the holder, the chancellor of the university, or his appointee, is mutually accepted as arbiter

The advantages accruing from these fellowships, according to Prof Duncan, are that the university gains increased opportunities for promoting research, that it obtains three hours a week of gratuitous and skilled instruction, that the manufacturer obtains the advantages of vastly increased laboratory facilities and full library facilities (for lack of which factory research has been most seriously hampered in the past) that the manufacturer has consultative advantages, since the fellow appointed is at liberty to question specialists in the different fields of chemistry, that the manufacturer is freed from supervision of the work of research, and that on the termination of the fellowship he obtains, if he so desires, the services of a man educated to this particular need As regards the fellow, he co-operates in the advantages above ascribed to the manufacturer, he obtains an inside knowledge of factory processes, and he is freed from the petty interferences and jealousies of shop employees and the "pot shop" judgments of factory officials. Moreover, if he makes good, he obtains a position for which his training during the fellowship renders him peculiarly qualified.

Finally, since at the end of the three years' term, all work done under any fellowship must be published free to the public, the latter becomes one of the most important beneficiaries of the new system. The insertion of this last clause was at first resisted by some of the manufacturers, but in the end the donor, when it was pointed out to him that a really progressive manufacturer would find that three years would give him a sufficient start of competitors, withdrew his objections

THE MOON AND RADIO-ACTIVITY

THE probable influence of the moon's movement upon the radio-activity of the air is brought out by M Paul Besson in a paper presented to the Académie des Sciences We find that different authors show great variations in the radio-activity of the air and M Besson concludes that this radio-activity comes from the ground, as Elster and Geitel also suppose He made experiments in the summer of 1908 and 1909 and showed that the variation in the activity of mineral water varied with the atmospheric pressure, being highest when the pressure lowered Other authors observed the same fact When the barometer descends the emanation from the soil increases, and the contrary But he noticed other variations which were unaccounted for, and thought that they might come from the tidal movement of the earth's crust, which was shown in a striking way by M Charles Lallemand of the Bureau of Longitudes When the moon passes the meridian it causes a tidal wave in the earth's crust, and the emanation from the soil is maximum at this moment, and *vice versa*, at least as may be supposed The author's observations lead to the following conclusions As regards atmospheric pressure alone for a one-hour test which is constant with relation to the moon's passage at the meridian and thus excluding the moon's influence, the radio-activity increases when the atmospheric pressure decreases, as above noted As to the influence of the moon, we find that at a constant barometric pressure, the activity is maximum for the passage of the moon at the meridian and minimum for the passage at the other side The author hopes to make a more complete series of observations in order to establish his hypothesis If the law of variation of the emanation coming from the earth could be established, we would ascertain the principal cause of the variation of the air's radio-activity Should it be found that the moon's movement caused changes in the radio-activity of the air, we would have the proof that the moon has an influence on the changes of weather, according to the popular belief, this being caused by multiplying or lessening the centers of condensation of water vapor, outside of air pressure effects and others.

Mr T H Svedberg has succeeded in obtaining by ultra-violet radiations, colloidal solutions of various metals in different liquids. The metal to be pulverized should be perfectly freed of any surface oxides. After being covered with the solution in a flat bowl, it is exposed from above to the radiations of a quartz glass mercury lamp. After a few minutes the liquid, when observed in the ultra-microscope, shows the characteristic aspect of a colloidal solution. Different metals and solutions show a rather different behavior. Thus silver, copper, tin and lead were found to be quite readily pulverized colloidal solutions, whereas platinum, aluminium, and cadmium show only a very slight, if any, pulverization. The experimenter carried out investigations with lead and silver not only in water, but in a number of other solutions, and showed that the magnitude and number of particles may be very different, according to the conditions of the case, pulverization being dependent on the nature of the solvent.

ENGINEERING.

We note that the Indiana State Railway Commission has recently issued an order requiring that all locomotives except those that are engaged in switching be equipped with headlights of not less than 1,500 candle-power

A train consisting of 120 coal cars, each carrying 55 tons of coal, was recently hauled a distance of 125 miles over the Virginian Railway in 8 hours, 11 minutes. The locomotive, which is of the Mallet type, weighed, with the tender 481,000 pounds, and the total weight of the train was therefore over 9,100 tons.

In view of the continual improvement which is taking place in the marine turbine the outlook for the early installation of the marine gas engine in ships of large power is not very promising Perhaps the future of the latter lies in the direction of small high-speed engines generating current to be used on slow-speed electric motors direct connected to the propeller shafts.

In the recent placing of a memorial window in Westminster Abbey to Sir Benjamin Baker, a fitting tribute was paid to a great engineer and a precedent was established which in this age of technical achievements must meet with universal approval The tablet reads "In Memory of Sir Benjamin Baker, Civil Engineer, Forth Bridge, Assouan Dam, B 1840, D 1907" It is probable that the series of windows, of which this forms one, will be reserved for commemoration of other famous engineers.

The warship has already surpassed the ocean liner in speed and she is rapidly overtaking her in size The new British armored cruiser "Lion" will be about as long as the "Oceanic" and of the same beam as the "Mauretania." At full speed, propelled by 70,000-horse-power turbines, she will make from 29 to 30 knots. With her eight 12-inch guns carried high above the water line, her four smokestacks and two tripod masts, this great ship will certainly present a most formidable appearance

The really extraordinary increase in the power of reciprocating engines due to utilizing the exhaust in a low pressure turbine will be understood when it is borne in mind that in expanding steam from say 150 pounds to a 28-inch vacuum, over 90 per cent of the expansion and over 40 per cent of the reduction in temperature occur below atmospheric pressure, or say, from about one pound gage to about one pound absolute It took the low-pressure steam turbine to recover the heat energy thus lost in the exhaust

We understand that the British government is favorable to the construction of a ship canal across Scotland from the Firth of Forth by way of Stirling, Loch Loman, and Loch Long, to the Firth of Clyde The plan proposed calls for 35 miles of lake navigation It is estimated that the work can be completed in nine years at an expenditure of about $100,000,000 If the canal be built to conform to naval requirements of a minimum depth of 36 feet and bottom width of 148 feet, with locks to match, the government will be prepared to co-operate with private enterprise

The improvement in roadbed, rolling stock and protective signaling on American railroads is shown by the Bureau of Railway News of Chicago, whose returns show that 340 roads operating over 153,000 miles of railway have not killed a passenger during a period of one year. It is true that toward the close of 1909 there was one of those curious epidemics of accidents which cast a shadow over this record, but the immunity mentioned above shows how vastly we have advanced over conditions of ten or fifteen years ago

A contract has been let for the removal of the fallen portion of the Quebec Bridge which now lies in a tangled mass upon the south shore of the river According to press reports the steel is to be severed for removal by means of a mechanical cutter, but we do not place much credence in the statement, for the reason that the obviously ideal method would be to use the oxy-hydrogen or oxy-acetylene flame, whose apparatus is so portable as to render it ideal for setting up in the many difficult positions which would be necessary

Comparative tests of consolidation and Mallet locomotives over mountain grades on the Southern Pacific Railway, under similar conditions of service, have shown all round economies in favor of the Mallet compound over the simple high-pressure locomotive of the standard type. The Mallet locomotive evaporated 7.81 per cent more water per pound of fuel, showed 14.04 per cent more ton miles per gallon of water used in the main cylinders, and 22.50 per cent more ton miles per pound of oil burned, and because of its greater size and power hauled 119.84 per cent more tonnage. The economy is due to the re-heating of the steam, the heating of the feed water, and compounding. The reheater and feed water heater reduced the smokestack temperature of the gases from 785.5 degrees in the simple engine to 451.5 degrees in the Mallet type.

ELECTRICITY.

Among the most important advantages of the "Pay-as-you-enter" car is the fact that these cars are safer to passengers getting on and off and fewer accidents occur from persons stealing rides Statistics have been compiled for the Chicago railroads which show that since "Pay-as-you-enter" cars were installed the number of accidents has been reduced 31 9 per cent.

A recent report of the American Telephone and Telegraph Company shows that at the end of 1909 the Bell companies owned 3,500,000 telephones, while 1,500,000 were owned by companies under contract agreements with the associated Bell companies. This is an increase of 600,000 telephones during the year The system comprises 10,350,000 miles of wire, 400,000 miles of which were added last year Half of the total mileage is underground

A test of Thomas A. Edison's storage battery car was recently made at West Orange, N J The car is 26 feet long and weighs 5 tons. It was fitted with two 7½-horse-power motors, and the operating cost is estimated at one cent a mile. During the test the car was operated at a speed of twenty miles per hour The motors are operated at 110 volts, and it is claimed that a run of 150 miles can be made without recharging the batteries

It has been reported that the Illinois Tunnel Company of Chicago is about to establish a system comprising 20,000 telephones which will be operated in competition with the present telephone system of the city The new system will make connections with long-distance independent lines. The Tunnel Company put in a system of automatic telephones ten years ago, but these are to be discarded and replaced with new and up-to-date apparatus

Metal filament lamps are now being used on ships and railroad cars. Such uses were considered impossible a few years ago owing to the frailty of the long filament required in these lamps, and it was supposed at the time that they could never be used anywhere but on a fixed support and hanging downward Now the filaments are so much stronger that in a recent railroad wreck the metal filament lamps in a car that was completely overturned were found to be in perfect condition and fit for further use in the regular service

At a recent meeting of the New York Electrical Society one of the speakers, lecturing on the subject of domestic electricity referred to a certain house that had been designed to be heated and lighted by electricity alone The house contains no chimneys stoves or coal storage room, and the saving in these requirements of the usual coal heating system was sufficient to pay for the entire electrical installation In regions where the cost of coal is high and water power is plentiful electric heating and lighting is no doubt more economical than coal heating

One of our large electric illuminating companies has found a new field for the consumption of electricity, namely, the Chinese laundry A Chinaman was induced to equip his shop with an electric washing machine and electric irons, and the photograph of this enterprising Oriental with his electrically equipped shop is being sent around among Chinese laundrymen, together with a letter written in Chinese calling attention to the advantages of modern methods in the laundry business It will be interesting to watch the success of this experiment

A carefully tabulated record of the cost of electric wagons and horse rigs used by the Commonwealth Edison Company of Chicago has just been published It shows conclusively that the electrically operated wagon is cheaper than the horse drawn vehicle and when we add to this advantage the fact that it makes a better appearance, is handier, and can cover ground in less time, enough has been said to show that the electrically operated wagon is far superior to the horse drawn vehicle and will undoubtedly displace it. Attention should also be called to the fact that the cost of the horse drawn rig is increasing each year, particularly because of the rise in the price of feed.

A thunderstorm observatory has been established in Spain by Senor G J de Guillen Garcia, in which atmospheric discharges, both local and distant, are detected graphically and acoustically A wireless telegraph instrument is used for this purpose, because each lightning discharge is accompanied by electromagnetic waves similar to those used in wireless telegraphy If there is a storm anywhere within a radius of 500 miles the observer is notified of the fact by the recording instrument. As all barometric depressions that pass over Western Europe come from the Atlantic Ocean, the new observatory gives meteorologists due warning of the approaching disturbance. By noting the intensity of the sounds produced in the receiver and observing whether they grow more distinct or less, it is possible to determine the approximate course of the storm.

SCIENCE.

Lieut. Ernest H. Schackleton has announced that he will enter upon another Antarctic expedition The date of the expedition has not as yet been decided

The Brooklyn Public Library has published a little pamphlet on "Aeronautics or Aerial Navigation, which comprises a list of books and references to periodicals in the Brooklyn Public Library on the subject of aeronautics The list is fairly complete, and may be regarded as an excellent bibliography of a most timely subject.

A tyrannosaurus has been placed on exhibition in the Dinosaur Hall of the American Museum of Natural History This dinosaur measures 40 feet in length The jaws of the massive skull are four feet long and are armed with sharply pointed teeth Tyrannosaurus was probably the largest carnivorous animal that ever roamed the earth

The Scott expedition in search of the South Pole is now assured The British government has promised $100,000 toward the $200,000 which is the estimated expense A total of between $55 000 and $60,000 has been raised by public subscription In all likelihood the expedition will start in July Capt Scott commanded the British Arctic expedition of 1900-1904 Shackleton was one of his lieutenants

Many attempts have been made to use old newspapers and other printed sheets in the manufacture of white paper, but the removal of the printers ink from the fiber has hitherto presented an insuperable difficulty In a process recently patented in Germany the paper pulp is treated with alkaline solutions of peroxides of the metals of the alkalis and alkaline earths, which so alter the greasy part of the ink that it ceases to bind the lampblack and other pigments, which are then easily separated from the fiber by emulsifying the pulp with gelatinous silica.

An international agreement for the prohibition of the use of saccharine has been instigated by the French government Favorable responses were received from Germany, Austria Hungary Belgium, Greece, Italy, the Netherlands, Portugal, Russia and Switzerland, and a meeting of delegates from these countries was held in Paris, under the presidency of the French minister of foreign affairs The commission closed its session on November 19th with the adoption of a formal prohibition of the use of saccharine in foods and beverages The French government will transmit this prohibition to the governments of the other countries for ratification

A recent German patent describes the preparation of a casting mass composed of slaked lime and water, with small quantities of alkali and a carbohydrate 100 parts of a stiff paste of well-slaked lime, containing approximately equal amounts of lime and water, are mixed with 1 or 2 parts of a carbohydrate free from water such as gum arabic, dextrin or sugar, and an equal quantity of a potash or soda salt which is decomposed by lime The mixture becomes as fluid as if a large quantity of water had been added to the lime, but soon solidifies and retains the form of any mold into which it is poured If about 2 parts of cellulose wood pulp or other fibrous material are added, good imitations of wood and ivory can be made

The investigation of the spectra of the planets, which was begun at Lowell Observatory in 1902, has been continued The result of recent work is given by V M Slipher in a bulletin just issued Slipher found a combination of dyes which renders the sensitiveness of the commercial dry plate fairly uniform into the red as far as to wave length 7 000 beyond which point it drops rapidly, but is sufficient at A to record faintly that line in the prismatic solar spectrum With the aid of this plate the spectra of Jupiter Saturn Uranus and Neptune have now been photographed with greater extension into the red than any previous photographic or visual observations and a number of lines and bands have been discovered

The beet is one of the most valuable of cultivated plants The red garden varieties furnish savory table vegetables, the large forage beets form an excellent food for cattle, and the sugar beet is one of the principal sources of sugar and alcohol The usefulness of this valuable root has now been increased by the production of an edible flour from sugar beets The desiccation of sliced sugar beets (Zuckerschnitzel) is already practised in Germany on a very extensive scale but the product is employed exclusively as fodder for cattle In Belgium, however, a meal is now made from dried beets which, according to a paper read before the recent chemical congress in London is entirely free from the distinctive flavor of the beet and is suitable for use in making cakes, puddings, and pastry As it contains about 65 per cent of sugar it can often be substituted, with advantage, for sugar, in somewhat larger quantities The processes of desiccation and grinding not only cost less than the extraction of sugar, but preserve all the sugar of the beet, part of which is rejected in the form of molasses, in the process of sugar making.

A NEW ERA OF THE AMERICAN LOCOMOTIVE

TWO REMARKABLE ENGINES

It is not stretching the point too far to say that the design of the locomotives herewith illustrated, one for passenger and the other for freight service, marks a new era in the development of the American steam locomotive. This is particularly true of the passenger locomotive, with which, by the introduction of the Mallet articulated piston, it has become possible to haul heavy fast passenger trains which with the present type of locomotive, it is necessary to run in two sections. Moreover, so powerful is this engine that it can haul over the heavy grades of the mountain divisions transcontinental trains which at present call for the assistance of an extra locomotive.

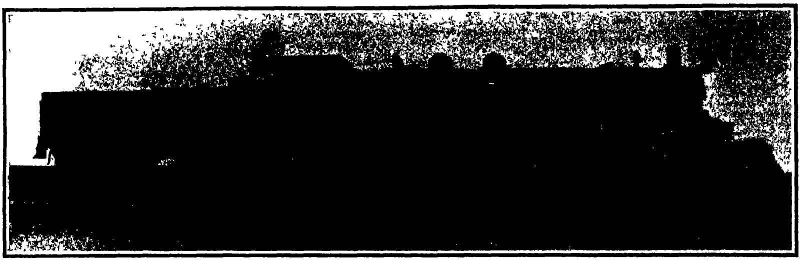
The Mallet articulated freight locomotive is already familiar, but the claim to distinction of the truly mammoth affair recently built for the Santa Fe Railroad is based on its great weight of 850 tons and its tractive force of 54 tons, both of which figures greatly exceed those for any previous freight locomotive. Both locomotives were built by the Baldwin Locomotive Works for the Atchison & Santa Fe Railroad.

The most important novelty, common to both engines, and the one which marks a distinctly new era in locomotive practice in this country, lies in the means which have been taken to transform the locomotive from one of the most wasteful into a reasonably economical power plant (if we may use the term). This has been done in both engines by utilizing the great length of boiler space afforded by the articulated system of construction. As will be seen from our sectional view, the boiler proper terminates above the high-pressure cylinders. The shell, however, is extended forward to the low-pressure cylinders, and within it are placed two nests of fire tubes, through both of which the hot gases pass on their way to the smokestack. The first of these is divided by a diaphragm into a super heater and a re-heater, the second forms the feed water heater.

Now, in the ordinary locomotive the gases, still very hot, after emerging from the front end of the fire tube, pass out through the smokestack and waste an enormous amount of useful heat into the atmosphere. The Santa Fe locomotives return a large part of this heat to the boiler and engine. Referring to the diagram, it will be noticed that these heat recovery devices first serve to raise the temperature of the steam as it passes from the steam dome to the high pressure cylinder. Then the gases yield up still more of their heat to the exhaust steam as it passes from the high-pressure to the low-pressure cylinders, the heat so taken up by the steam serving in each case to raise the heat energy of the latter. Finally the gases pass through a large nest of tubes, around which the feed water is caused to circulate and is raised to the boiling point, as it travels from the tank on the tender to the boiler.

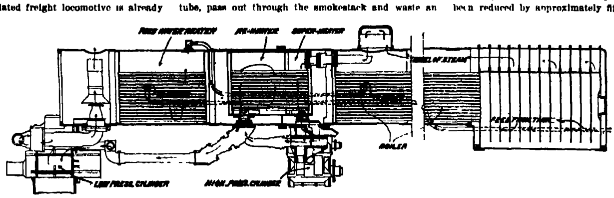
The advantages of this system are that not only is a much larger percentage of the heat energy of the fuel turned into useful work, but the super-heating and re-heating enable the well known economies of compounding to be realised to the fullest extent. As a consequence the coal consumption per ton mile has been reduced by approximately fifty per cent, ten per cent of which is estimated to be due to super-heating and re-heating, fifteen per cent to feed water heating, and twenty-five per cent to compounding. These figures are at present merely an estimate, but we see no reason why, with proper firing and intelligent handling of the throttle, these great economies should not be realised in actual service. The Santa Fe passenger locomotive embodies the first attempt to apply the articulated system to passenger service. The proportions are enormous, far exceeding any existing passenger locomotive either here or abroad. As far as cylinder and driving wheel arrangements are concerned, the engine is practically a combination of the

(Continued on page 113)



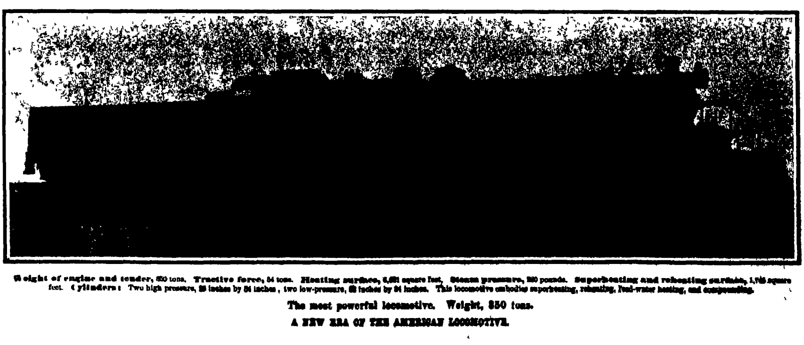
Weight of engine and tender, [illegible] tons. **Tractive force,** [illegible] tons. **Heating surface,** 4,756 square feet. **Steam pressure,** 200 pounds. **Superheating and reheating surface,** 1,181 square feet. **Cylinders:** Two high pressure, 24 inches by 28 inches; two low pressure, 38 inches by 28 inches. **Driving wheels,** 73 inches.

The most powerful passenger locomotive in existence.—A new type



In this boiler part of the heat in the furnace gases which is ordinarily lost through the smokestack, is utilised to superheat and reheat the steam on its way to the cylinders and to heat the feed water before it enters the boiler.

The new boiler which saves 25 per cent of fuel



Weight of engine and tender, 850 tons. **Tractive force,** 54 tons. **Heating surface,** [illegible] square feet. **Steam pressure,** [illegible] pounds. **Superheating and reheating surface,** [illegible] square feet. **Cylinders:** Two high pressure, [illegible] inches by 34 inches, two low-pressure, [illegible] inches by 34 inches. This locomotive embodies superheating, reheating, feed-water heating, and compounding.

The most powerful locomotive. Weight, 850 tons.

A NEW ERA OF THE AMERICAN LOCOMOTIVE.

PUTTING OLD NEPTUNE TO WORK

Twice each day millions of tons of shipping in New York Harbor are lifted to a height of over four feet and dropped the same distance by the tide This same work is done in every port to a greater or less degree. Many a man has enviously considered this enormous expenditure of power and racked his brains for a means of putting it to valuable service How ever, the work done by the tides is enormous only because of its vast extent and herein lies the delusion which many an inventor has failed to discover until he has devoted much thought and time on evolving a tide motor The work done in raising of the "Lusitania," for instance, which weighs 40,000 tons, represents an expenditure of energy of only sixteen horse-power, this being due to the fact that the tide acts very slowly, taking six hours to raise the vessel to a height of four feet.

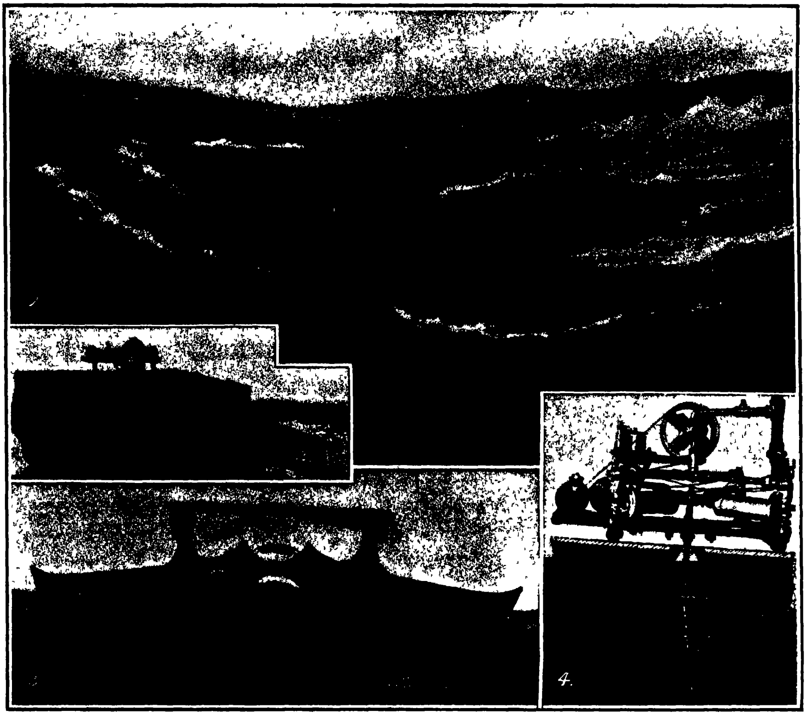
However, there is another form of energy displayed by the ocean which is far more powerful than that of the tide, and here there appears to be more opportunity for capturing a portion of this power and devoting it to practical use. The waves of the ocean are not so deliberate as the tides and the chief difficulty with which the inventor must contend is that in time of storm they develop entirely too much energy and are apt to wreck his machine.

In the accompanying engraving we illustrate some recent constructions which have been devised for the purpose of obtaining power from the waves. That shown in Fig. 1 consists of a large square float, on which the principal mechanism is mounted. Hinged to this float are four auxiliary floats and the rocking motion between the auxiliaries and the main float that is utilized to operate a series of pistons pumping air into a compressed air tank The compressed air tank and four pairs of cylinders are mounted on the main float The piston rods are connected at their outer ends to the four floats and when these floats are rocked by the waves they serve to reciprocate the pistons and pump the air This action takes place regardless of the direction in which the waves are traveling because the auxiliary floats extend in four directions.

An entirely different method of utilizing the force of the waves is shown in Fig 2. This consists of a large crib placed in the water and having one end open so that the waves will wash up over the floor of the crib as they do on an ocean beach At the back of the crib are a pair of curved deflecting walls before which is placed a triangular casing provided with a series of swinging doors or vanes. When the waves wash up the floor of the crib they close the vanes against the casing and divided by the prow of the casing are directed against the deflecting walls. The rear of the triangular casing is opened, permitting the water to flow through as the wave recedes and strike against the rear faces of the vanes opening them to the position shown in the illustration The vanes are geared to a series of piston rods which operate the cylinders to fill a compressed-air chamber. The latter, by means of a pair of air motors operates a dynamo and generates electricity which may be conveyed to any desired spot and utilized

Fig. 3 shows a construction similar to Fig. 1, making use of the rocking of two floats. The floats are hinged to each other and one carries a rack adapted to engage a pinion mounted on the other float. As the floats rock to and fro the pinion is rotated first in one direction and then the other, and this motion serves to pump air into a tank The air from the tank operates a pneumatic motor which in turn drives a dynamo and generates electricity In order to permit the floats to swing about in any direction without danger of fouling the anchor lines one of the floats is mounted on a swivel which is securely anchored By means of contact wheels engaging contact rings on the swivel the electricity generated is conveyed to a pair of cables which extend to the shore

The construction shown in Fig 4 depends for its operation on an entirely different principle It is well known that the wave disturbance of the ocean does not extend to any great depth and it is the relative motion of the surface water with respect to the water at a considerable depth that is made use of in this case to generate power A float is provided from the center of which projects a shaft fitted at its lower end with a set of radial fins When the float is rocked by the waves the shaft tends to remain vertical owing to these fins Mounted on the float are a series of cylinders provided with the usual pistons which are connected to an extension of the vertical shaft just referred to, and while the pistons remain virtually fixed the cylinders are reciprocated upon them by the rocking of the float The pistons serve to circulate oil through a rotary engine which in turn drives a dynamo and thus generates electricity When the wave motion becomes too violent an electrically-operated by pass permits a portion of the oil to circulate without passing through the motor and thus an excessive speed is prevented



Four novel methods of utilizing the power of the waves,

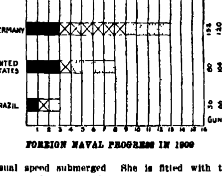
PUTTING OLD NEPTUNE TO WORK

FOREIGN NAVAL PROGRESS IN 1909.

BY PERCIVAL A HISLAM

During the year just closed considerable naval activity has been manifested abroad Not only have the principal naval powers adopted large programmes of new construction and made good progress with those already in existence, but the minor powers have shown in a practical manner how widespread a hold the Dreadnought fever has taken on the mind of the world

Great Britain during 1909 has finished the last of the trio of battleship-cruisers of the 'Invincible' type, of the details of which readers of the SCIENTIFIC AMERICAN are already fully aware through the appearance of the 'Inflexible' at the Hudson Fulton celebrations The three battleships of the 1906-7 programme—the 'Bellerophon,' Temeraire" and "Superb"—have all been passed into service They are of 18,600 tons, 700 more than the "Dreadnought," but differ only in having sixteen 4 inch 31 pounders for their anti torpedo armament as compared with twenty-four 12 pounders The end of the year saw also the completion of the battleship Vanguard,' of the 1907-8 programme which was turned out by Vickers, Sons & Maxim in the record time for any ship since the Dreadnought herself, of 19 months The "St Vincent and Collingwood' completing the 1907 8 trio, will be commissioned this spring All are of 19,250 tons, and have ten 12 inch 50-caliber guns (the main armament of the others is 45 calibers) and twenty 4 inch rapid fire weapons. The thickness of the main belt is reduced to 9¾ inches in these ships compared with 11 inches in the earlier vessels, but a larger area of the hull is protected by thick armor Other vessels passed into service during the year include the unarmored cruiser 'Boadicea," of 3 300 tons and 25 knots, designed to act as mother ship' to the destroyer flotillas, a number of 33 knot destroyers—'Afridi" (which had to be accepted at 32 75 knots) "Crusader,' "Amazon" Saracen," "Maori,' "Viking' and 'Zulu A new type of submarine has been completed This is the D1" of 600 tons, which showed



FOREIGN NAVAL PROGRESS IN 1909

unusual speed submerged She is fitted with twin-screws, and has a steaming radius of 4,000 miles.

The vessels launched during the year are the battleship "Neptune,' of 20 250 tons, with the same armament as the earlier Dreadnoughts, but so arranged that there is a broadside of the whole ten heavy guns, and the armored cruiser "Indefatigable," 19,000 tons, carrying the same battery as the "Invincibles," but longer, enabling a wider arc on either beam to be covered by the whole eight 12 inch guns A number of small cruisers and destroyers have also been launched

Three new battleships have been commenced They are the 'Hercules,' "Colossus," and "Orion," of the same displacement as the "Neptune,' but with the five 12 inch gun turrets arranged axially The armored cruiser Lion,' also laid down will be of 26,000 tons and 28 to 29 knots, and will carry ten 12 inch guns

Germany has had a record year in naval construction She has completed her first two Dreadnoughts, the 'Nassau" and "Westfalen," of 18,500 tons and armed with twelve 11 inch and twelve 5 9-inch guns. Both ships exceeded 20 5 knots on trial, although designed for 19 5 The armored cruiser "Blucher" has been commissioned as flagship of the High Sea Fleet's cruiser squadron This vessel cannot rank with the British 'Invincibles, but she is nevertheless a powerful ship, displacing 15,500 tons and steaming 24 5 knots on trial Her armament consists of twelve 8.2 inch and eight 5 9 inch guns, and her main belt is 8 inches thick The battleship "Rheinland," sister to the "Nassau ' is now running her trials, and the "Posen will follow this spring

Five large battleships have taken the water during the year Three of these are battleships—the "Ostfriesland" "Thuringen," and "Helgoland," each of 20,000 tons They are the first German ships to be armed with 12 inch guns Krupp's having built a 50-caliber weapon firing a 981 pound shell. Twelve of these guns will be carried as well as a similar number of 6.7 inch In armament at least, therefore, these ships will be greatly superior to any British ship yet launched. The armored cruiser "Von der Tann" has also been launched. She is of 18,700 tons and will steam 25 knots, her armament comprising ten 11-inch and a secondary battery, it is believed, of 5 9-inch guns. The cruiser "G," following toward the close of the year, is a sister ship

Two small cruisers, the "Kolberg" and "Mainz," have been completed. They are of 3,800 tons, carry fourteen 4 1 inch guns, and steamed 27 to 28 knots on trial The completion of destroyers continues a factor of naval strength in which Germany leads the world Her twelve vessels of the 1908 programme are in commission at a time when those of the British programme for the same year are only being launched

Three battleships have been laid down, similar to the "Helgoland," but equipped with turbines. They are the "Ersatz Frithjof," "Ersatz Hildebrand," and "Ersatz Heimdall" The armored cruiser "H," of the 1909 programme, was laid down in December, 1908, in advance of the orthodox date Two more small cruisers, twelve destroyers and some submarines have also been laid down

All the French battleships of the "Danton" class have now been launched They are of 18,400 tons and will carry four 12-inch and twelve 9 4-inch guns. Admiral Boue de LaPeyrere, the new Minister of Marine, has done much for the benefit of the naval service The next ships to be laid down, two of which will be started at once, will be of 23,400 tons and will carry twelve 12-inch and eighteen 5 5-inch guns

A start has been made in the re-creation of the Russian navy, and four battleships were laid down at the Baltic yards on June 16th last, where they will be built under the supervision of the British firm of John Brown & Co Their names are "Gangut," "Petropavlovsk," "Sevastopol" and "Poltava," and on a displacement of 23,000 tons they will carry twelve 12-inch and sixteen 4 7 The designed speed is 23 knots. The two Black Sea battleships "Andrei Pervosvanni" and 'Imperator Pavel I" have been completed, as well as the small armored cruiser "Pallada," 7,900 tons. The former are 17,250-ton vessels, carrying four 12-inch twelve 8 inch and twenty 4 7 inch guns.

The progress of Japan is difficult to follow, owing to the contradictory reports that emanate from that country However, two battleships have been laid down—the "Kawachi" and "Settsu," of 20,800 tons, armed with twelve 12-inch, ten 6-inch and twelve 4 7 inch guns The "Satsuma,' laid down in 1905, has been passed into service Displacing 19,250 tons, she carries four 12 inch, twelve 10-inch and twelve 6-inch guns Much difficulty is found in turning out ordnance fast enough to supply new ships, and the armored cruisers "Ibuki" and "Kurama," laid down in 1905, are still delayed by this cause Two new cruisers, the 'Huki' and "B" have been laid down. On 18,650 tons they will carry six 12 inch and fourteen 6-inch guns, and steam 25 knots

Among the lesser powers Italy has laid down four large ships. The "Dante Alighieri' and 'Cavour' (late "Leonardo da Vinci") will carry twelve 12 inch, and the "Michael Angelo" and "Galileo-Galilei," it is reported, eight 14 inch Austria has launched three battleships and proposes to build four 19,000-ton vessels as soon as financial difficulties have been overcome The first of the three Spanish ships, the "Espana," has been commenced, and will carry eight 12-inch guns on such a low displacement as 14,760 tons The Brazilian "Minas Geraes," with twelve 12-inch has been completed, the "Sao Paolo" is nearly ready for trials, and the "Rio de Janeiro" has recently been laid down The Argentine is going to have two battleships built, and Chile one A Chinese naval commission is touring Europe with the ultimate object of placing orders for three 15,000-ton ships; Turkey has sent Admiral Gamble back to England with instructions as to the ordering of two battleships, and Greece has allotted five million dollars for the purchase of an armored ship from an Italian firm.

HOW AN AMATEUR MAY FIND HALLEY'S COMET.

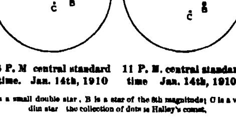
BY REV RUEL W ROBERTS.

Thinking it a laudable ambition to be the first amateur to find Halley's comet, I have been working with my 3¼-inch telescope for several weeks trying to locate it. I have not learned as yet that I am the first, but being confident that I have succeeded in finding it, I have thought that other amateurs might like to know how it might be done Since the easy method here described may also be employed by amateurs in other simple studies of the heavens, I have gone somewhat into details. Despite the fact that some astronomical journals have said that it would be some time before the comet in question could be seen in a small telescope, I have the word of a prominent astronomer that it can now be seen in even a 3-inch—provided, of course, one knows where to direct his telescope.

So the first problem is to ascertain the position of the comet. There are very few amateurs who have telescopes mounted with circles. Hence we must adopt a plan that will enable us to find it without such aids. Of course it would be an easy task to locate it if one had all the equipment of an observatory, merely by setting the telescope in the proper right ascension and declination.

Now if we will turn to the recent files of the SCIENTIFIC AMERICAN, we may find the right ascension and declination given for every other day during January and February. The data for the intermediate days can be easily deduced by taking half the difference of any two alternate days and adding it to the reading of the previous day Next we need a good star atlas. Upton's is the one recommended in Young's Astronomy, and is the best for the average student. Such a star atlas should be one of the first books owned by an amateur Almost any good library can furnish you with such an atlas if one is not already at hand. Then with the ephemeris before you follow the course of the comet from day to day by tracing the right ascension and declination on the map. Note the day when the readings first come near to some prominent star This will be the time to put the method to trial. In order to know exactly how near the comet will be to the star, consult the Nautical Almanac or any other source accessible to find the R. A. and Dec. of the star Upton or other star atlases will give the data for some of the stars.

By this process I found that on the evening of November 30th the comet was to be near Aldebaran in Taurus, so I began in good season to make my trial The evening before I made four carefully constructed charts of the stars visible in my field of view I used my 45-power eyepiece, and this meant about 40 minutes or 43 minutes of arc, in the field. Upton on page 14 gives the R A of Aldebaran as 4 hr 30 min., and the Dec as +16 degrees 19 min. The R. A. of the comet on this day was 4 hrs 30 min., and the Dec. +15 degrees 56 min The R A is the same, and the Dec places it 23 min. south of Aldebaran This would bring it within the field of view of the telescope. One can estimate quite accurately the number of minutes of arc within the field of view of the telescope by sighting it upon some object whose size is known. The moon is suitable for the smaller powers It is 32



6 P. M central standard time. Jan. 14th, 1910 11 P. M. central standard time Jan. 14th, 1910.

A is a small double star, B is a star of the 8th magnitude; C is a very dim star the collection of dots is Halley's comet.

min of arc in diameter Epsilon Lyraee may be used for the higher powers. The two principal stars of this double (in reality a quadruple star) are 3 min apart. My 200-power presents a field of vision of about 6 or 7 min. Now if the polar axis of the telescope is pointed exactly to Polaris, it would be necessary only to make one map of the desired area and estimate the 23 min distance to the south I had my telescope, on this particular evening, directed from a second-story window and was not sure of my exact polar location, so I drew the four maps, hoping to be more certain of including the comet within the list. In making such observations and trying for a definite location north or south, east or west, one must bear in mind the fact that an astronomical telescope inverts the object. A little study with the moon, which can also be observed with the naked eye, will help to straighten out this matter Now after making these four maps on the evening of the 29th, I planned to observe carefully the next evening to see if I had any object in view not viewed the night before But the evening of the 29th was dimly illuminated by the coming rising of the moon, while the second evening was much darker, and I found many new stars in view While I had thus planned to locate the comet by a process of addition (and this would have been the more desirable as it would have enabled a more careful scrutiny) I decided to look for it the next evening by a process of elimination So on the evening of the 30th I carefully made four new maps of the same areas like those shown in the engraving and made about two weeks ago. Something like sixty or seventy stars appear in the cuts. After several evenings one star on the maps failed to appear again, I indicated this position by a small circle. So I concluded that this was the comet. I have since verified it by a sketch furnished me by a prominent astronomer. As it appeared in my telescope it had no such comet characteristics as a tail to enable one to readily recognize

(Continued on page 112.)

THE LAKE WASHINGTON CANAL.

A public work of much importance, though not widely known, is the proposed canal connecting the tidal waters of Puget Sound with the fresh water lakes, Union and Washington, lying in or adjacent to the city of Seattle, Wash. The project is a very old one, though it has yet progressed no further than the acquirement of right-of-way, the formal adoption of a project by the War Department and its submission to Congress, and certain local measures now in progress for the raising of funds to aid the government in the work.

The canal is to be a joint enterprise, to the cost of which the government and the local community will ultimately contribute about equal shares. The local community has already acquired and delivered to the United States the right-of-way, costing about $250,000 It will excavate the channel at a cost of about $1,000,000 The railroads, street car companies and city will have to construct bridges and other crossings at their own expense, so that the entire local outlay will probably foot up about $2,500,000 The government will build the lock and controlling works and a power plant. It will also build the entrance works and take care of certain other features of the project and will maintain and operate free of toll the completed work The cost to the government will be about $2,500,000

Following are some of the benefits of this work which justify its construction and which also justify a division of the burden between the government and the local community

It will be of great value to the navy by giving an admirable fresh water waiting basin for vessels laid up in ordinary time of peace Puget Sound will always be an important naval rendezvous, and the Navy Yard is only 18 miles from the canal entrance.

It will give a much needed expansion to the harbor facilities of Elliot Bay The practically available frontage on the Bay does not exceed 5 miles, and a large part of this is in the hands of the railroads. The opening of the lakes will give fully ten times greater frontage than at present, and much of it better situated for public convenience It will make accessible extensive sites suitable for manufacturing establishments The areas at present available, where both rail and shipping facilities can be had, are extremely limited

The completion of the canal will give much needed anchorage grounds for shipping Many vessels are laid up during the winter, and owing to the excessive depth of water in Puget Sound, suitable anchorages are very scarce Not only will the lakes afford better anchorage grounds, but they are free from the destructive effects of marine life which is very active in the waters of the sound The hulls of vessels will suffer much less deterioration than in salt water Likewise subaqueous timber construction, which cannot be depended upon for more than a year in the sound unless the timber is "treated," is practically imperishable in fresh water The shallower depths also will be much less expensive for wharf construction and maintenance

The lakes are, of course, entirely free from tidal fluctuation, which on the sound has a mean range of 10 feet and an extreme range of 18 feet The fixed level will be a great gain in all shipping operations.

The foregoing advantages are of a general character, but there are others of a purely local character that are very important.

The cost of drayage in Seattle is large because of the extremely uneven topography of the city and the absence of good grades leading up from the present water front. The canal will flank the hills, distribute freight throughout the city and reduce the cost of drayage, it is estimated, by 25 to 50 cents a ton. This saving will in a few years equal the local contribution to the cost of the canal.

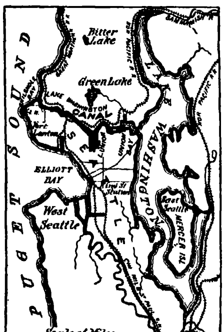
The lowering of Lake Washington to the level of Lake Union will drain all swamp areas around the shores of the lake, relieve the valley of Black and Duwamish rivers of the floods of Cedar River by turning the latter stream directly into the lake, and will make the whole run-off from the Lake Washington and Cedar River watersheds (580 square miles) available for power at the lock site. Drainage, flood protection, and accessibility to shipping will greatly enhance land values around the lakes. Lake Union will become virtually a great dock in the very heart of the city.

The removal of the natural barrier between the two lakes and the establishment of a connection with the sound will greatly enlarge the field of pleasure boating which already plays a large part in the life of the local community. Some fear is felt that the proposed changes will detract from the natural beauty of Lake Washington, but a careful analysis of the question shows that the effect will be imperceptible after a period of two or three years, and will result in improvement, so far as there will be any noticeable change.

The right-of-way for the canal is 300 feet wide. There will be a single lock with a large and small chamber. The large lock or chamber will be about 800 feet long by 80 feet wide and 36 feet deep and will take any vessel likely to visit Puget Sound for many years to come The little lock will be 150 feet long by 30 feet wide and 16 feet deep and will be used by small craft of all descriptions, the number of which is very large and rapidly increasing. Probably 90 per cent of transfers of vessels will be through this lock

The entire structure will rest on an excellent foundation of very hard, tenacious blue clay of great depth It will be built of reinforced concrete and steel and will embody the best features of modern lock construction The controlling works at the lock will consist of a power house by which the entire flow through the canal will be turned to use. The great reservoir formed by the lake gives complete control of the run-off and distributes the flow quite evenly throughout the year The revenue from this power will return about 14 per cent on the cost of the plant and will nearly pay for the future operation and maintenance of the canal The problem of maintenance will be greatly simplified by the entire absence of sediment in the water and consequently of deposits in the canal and the necessity for dredging The physical problems involved in the building of the canal are of the simplest character

This canal has been the dream of Seattle ever since it began its existence, but the rapid growth of the city and the great variety of interests affected create opposition here and there which has succeeded in delaying the work much longer than should have been the case It is now expected that the project will be completed within the next three or four years



This great salt water lake will form an excellent harbor for laying up naval vessels and will increase harbor frontage of Seattle

THE LAKE WASHINGTON CANAL

The Boy's Endorsement.

Standing fifth among books most in demand during the week ending January 18, 1910, as reported by the Circulation Department of the New York Public Libraries, is "The Scientific American Boy," by A. Russell Bond This endorsement from the boys themselves counts for more than the many favorable reviews that this book has received Boys are not influenced by the criticisms that appear in magazines, nor to a great extent by advertisements The fact that they frequently call for a book at the library is evidence that they thoroughly appreciate that particular work "The Scientific American Boy" takes up the story of a group of boys who built tree huts, log cabins, caves, bridges water wheels, tents, tramping outfits, etc. A sequel to this book has just been published, entitled "The Scientific American Boy at School," which continues the story and tells how to make a variety of things, including dams, boats, gliding machines, sun dials, canoes, and many new devices for outdoor recreation

The Current Supplement.

Some Curtis turbine driven units of 14,000 kilowatts capacity are in course of construction at Schenectady What 14,000 kilowatts means is shown in the Current Supplement by illustrating the amount of condensed water required, coal consumed, etc. The subject of marine propulsion by electric motors is presented. Lucien Fournier describes an automatic machine for registering letters A method is described for the handling, transporting and evaporating of liquid hydrogen for the inflation of balloons. Mr Albert Moyer, the well-known authority on concrete, presents a paper on the possibilities of the uses of mineral oils mixed with concrete. The treatment of disease by injecting into the blood the serum, or watery part, of the blood of an animal that has been made immune to that disease is popularly discussed by Dr Fritz Meyer Dr V Grafe contributes an excellent article on the miniature art of Nature and Science Suggestions are made for observing Halley's comet. Dr H A Gins writes on the optical method of studying immunity to bacterial disease Many of our readers have no doubt wondered how an explorer can really prove that he reached the Pole, in view of the recent Copenhagen decision The method of examining an explorer's notes and ascertaining whether or not he reached the Pole is excellently presented by Professor J Hammon Smith

Correspondence.

WHY BAND SAWS BREAK

To the Editor of the SCIENTIFIC AMERICAN

Mr H Miner of Lumberton, Miss, has inserted an article in your valuable paper, the SCIENTIFIC AMERICAN of November 13th, 1909 concerning the causes of breaking of springs He also relates the breaking of bandsaws, which is a very important point to overcome, as it is a well known fact to all who use bandsaws that a saw after running a few hours becomes longer in the back edge on account of the back pressure from the saw guide which gradually brings the tension more and more toward the teeth or sawing edge

If any little cracks exist by reason of improper finishing they will certainly increase and the flaw will break If the manufacturers of bandsaws would study this matter they would soon find out that the fault lies in the careless way of making the steel and preparing it for a saw

Manufacturers who have won reputations for making bandsaws in smaller sizes as from ¼ inch to ½ inch, are looking for too great a profit and forget to make use of the same skill exerted in making bandsaws for exhibition

By an average approximate estimate a ¾ inch bandsaw will not run long enough to wear for one-half dozen filings before it is broken in so many places that it is impossible to make any more use of it.

Chicago H JOHANSEN

A CURIOUS PHENOMENON.

To the Editor of the SCIENTIFIC AMERICAN

While driving along the shore of Canandaigua Lake, in the State of New York, on Tuesday, January 4th, I observed a curious natural phenomenon

The temperature of the air was six degrees above zero, a light northwest wind blowing and the bright sun of the afternoon occasionally obscured by the presence of large and low hanging cumulus clouds.

The surface of the lake was covered by vapor caused by the difference in temperature between the cold air and the comparatively warm water This vapor visible in the form of a slowly rising, dense, white mist gathered in spots in masses rising higher than the surrounding mist As these masses of vapor reached a height of some twenty feet they appeared to take on a rotary motion and formed themselves into columns slowly rising until their apexes met the low lying clouds, where they spread out in a funnel shape exactly as do water spouts The columns varied from a foot to possibly ten feet in diameter, some of them ascending in a straight line and others bent into fantastic curves by the action of the wind I saw a great number of these mist whirls during a drive of some two hours, covering a distance of ten miles along the lake shore, and as they formed and drifted slowly across the water illuminated by the rays of the setting sun, they were a beautiful and to me a unique spectacle

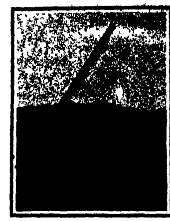
Can you tell me if similar phenomena are often observed? JAMES S. LEE.

Boston

Speaking before the Royal Society in London on the subject of magnetic storms Mr E W Maunder superintendent of the Solar Department of the Royal Observatory, Greenwich said that magnetic disturbances were in some way connected with the rotation of the sun upon its axis It was clear that, besides sending us light and heat the sun sent some kind of influence which came only from certain portions of the surface and came along closely restricted lines They found there was a tendency for magnetic disturbances to take place when a sun spot had got to a definite portion on the sun's disk If they took it that the influence that came from the sun and struck the earth came from the center of the sun spot, they would be able to calculate how long it had taken place, and, assuming that, they found it would take about twenty-six hours to come from the sun, a distance of 93,000,000 miles, to the earth

A GREAT OPEN-AIR TELESCOPE

BY PROF. S. A. MITCHELL
COLUMBIA UNIVERSITY



A giant telescope has been erected in Germany having for its main purpose the making of astronomy popular through exhibitions to the public of the heavenly bodies. The United States has repeatedly followed Germany in her advances along scientific lines and here would be a splendid opportunity to emulate her by the erection of a great public telescope (say) in New York city.

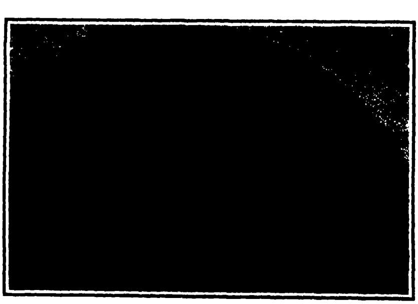
A contrast of this new German telescope at Treptow (near Berlin) with the highest development of American manufacture proves of the greatest interest. In the Yerkes telescope (see SCIENTIFIC AMERICAN December 25th 1909) we have a great instrument given over to exact research, handled by a corps of expert astronomers leaders in their special lines of work. Prof. E. E. Barnard is there with his keen eye for the measurement of the positions of comets, star clusters, etc., for the depicting of slight planetary details, or with the help of the photographic plate for the portrayal of Mars on a large scale. The greatest living authority on double stars Prof. S. W. Burnham spends two nights each week with the great 40 inch refractor. The director, Prof. E. B. Frost, takes care of the spectroscopic side of astronomy by photographing the spectra of stars for the determining of their motions in the line of sight and by day time the telescope is made use of to learn of interesting phenomena about the sun. This great telescope is a model of engineering perfection with its great tube and massive parts rising floor and rotating dome. It is mounted in what is known as the equatorial form.

But how different is the Treptow telescope! Erected with other purposes in view, it is not necessary to have expert scientists to keep the telescope employed almost every hour during the day and night constructed under a different plan it is unnecessary to have a great elevating floor inside of a huge rotating dome, for in fact the dome is done away with and the telescope is used in the open air! This then brings something radically new in the old science of astronomy, something entirely different in the construction of a great telescope. And this new form of instrument has many points in its favor that make it a most interesting telescope.

The director of the Treptow Observatory, Dr. F. S. Archenhold, by his radical ideas came into opposition with the German scientists who ridiculed the idea of placing in the open air with no protection from the wind a great tube 68 9/10 feet in length seven feet longer than the Yerkes telescope (62 feet). But undaunted, Dr. Archenhold persevered and finally succeeded in collecting sufficient funds for the erection of the largest telescope in the world. And this, too in scientific Germany!

The front page illustration shows the Treptow telescope. The old equatorial form of mounting was departed from, for this requires that the eye-end of the telescope be raised through a vertical distance approximately half the length of the telescope tube in viewing a star overhead and one near the horizon. This necessitated a very expensive elevating floor run by electric motors (SCIENTIFIC AMERICAN, December 25th, 1909). By swinging the telescope tube in a great fork and employing suitable counterpoises Dr. Archenhold was able to have the eye-piece near the center of motion and run the telescope tube upward into the air. The details of this will be readily seen by referring to the illustration. This eliminated the rising floor and saved many thousands of dollars. The low forked mounting with its heavy movable parts placed on a solid concrete foundation insured a stable instrument and as the whole construction had no great height it became possible to house the telescope by turning the long telescope tube into a horizontal position and pulling over it a cheap portable house. By using the telescope in the open air it became possible to entirely eliminate the great dome, and thereby save again more thousands of dollars. The result of these plans were that Dr. Archenhold was able to build the completed instrument for the modest sum of $62,500. Of this sum $11,500 was spent for the lens, which was made of the celebrated Jena glass ground by the old-established firm of Steinhiel, in Munich. The lens is 27 inches in diameter, and is an excellent one.

The radical departure from old-established forms in eliminating the dome has many points in its favor besides the more saving of money, and also many drawbacks. As is well known to astronomers, the temperature of the night air is continually falling (especially in the early part of the night), and it is impossible to have the air in the interior of the dome at the same temperature as the outside air. This causes the heated air to pour out through the slit of the dome, and also produces currents of air in the interior of the telescope tube itself. All of this makes "bad seeing," and a distortion of the telescopic image—the bane of the existence of the professional astronomer.



View taken under the mounting, showing the electric motors for driving the telescope.
A GREAT OPEN-AIR TELESCOPE.

Dr. Archenhold's plan of doing without a dome eliminates most of the effects of air currents, for there is no "dome effect," as astronomers call it, and the air in the telescope tube quickly takes the temperature of that outside. Here, then, is a decided advantage. But unfortunately the telescope being in the open air makes it the sport of every passing wind, and even a slight wind is apt to set up a vibration in the telescope, especially so when the tube is so long as in the Archenhold telescope, which is supported not in the middle, as in the ordinary telescope, but entirely at one end. Though the vibrations may be small and imperceptible to the eye, still when the telescope is pointed at a fixed star the immense magnifying power of the long telescope would make even the slightest tremors readily visible and would spoil the use of the instrument for accurate work. It would seem that for the important researches of the exact astronomer the open-air telescope would be a failure, but for public exhibitions only it is another story. The absence of dome and rising floor eliminates a great amount of the expense, and the modest amount of the popular subscriptions can be all put into the construction of a telescope thus obtaining a much larger instrument. The telescope is raised and a star located by means of a 6½-horse-power electric motor. In order to keep the telescope pointed correctly at the celestial object, it is necessary to drive the telescope to make it move from east to west, otherwise owing to the earth's rotation the object would quickly move from the field of the telescope. In the Treptow telescope both observer and instrument must be moved, and the details of how this is done by a ½ horse-power motor regulated by clockwork can be seen in the smaller illustration.

The Cost of Our Navy.

IT COSTS A GOOD DEAL OF MONEY TO RUN A NAVY

The actual expense of running the navy of the United States for the past fiscal year amounted to $43,790,000. In this sum is included everything, from the pay of enlisted men to the repairs and equippage of vessels. And the vessels include the tugs and receiving ships as well as the battleships.

The battleship "Connecticut," flagship of the Atlantic fleet, may be taken as an example of the cost of keeping a vessel of that type in service. The pay of officers and enlisted men attached to this vessel with the other expenses amounted to more than $790,000 during the fiscal year just passed. The Atlantic fleet in that period included sixteen first-class war vessels viz., six of the "Connecticut" type, five of the "Georgia" class, and the others ranging from 13,000 tons to 11,500 tons. The average cost of keeping a vessel of the "Georgia" class in commission, not including repairs, is $677,500 a year. The classes below the "Georgia" require expenditures ranging from $532,000 to $604,000. While the figures will vary for the same vessels in different years, the cost changes vary little from year to year for the same class. $10,521,000 was the total cost for running the sixteen ships of the Atlantic fleet for the past year. There were twenty-three first-class battleships in commission last year, and the total cost of keeping them in service exclusive of repairs, was $13,035,000, making an average cost for running them $592,084. On all these ships the repairs amounted to only $100,-496.

It might seem strange, but it is a fact nevertheless, that it costs more to maintain a cruiser than it does a battleship. There were ten armored cruisers in commission last year, the total cost of running amounting to $7,150,600, or an average per ship of $715,060.

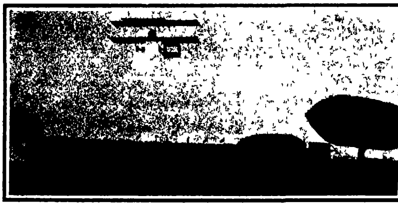
It would seem at the present time that there is to be no limit to the increased size of future battleships, and naturally there will be an increased cost of running expenses. For instance, the latest battleships to be placed in commission, the "Michigan" and the "South Carolina," each require a crew of 51 officers and 818 men. These vessels are of 16,000 tons displacement. The next that will be ready for service are the "Delaware" and "North Dakota," each of 20,000 tons displacement. Each of these fighting crafts will require 55 officers and 878 men. Then will come the "Florida" and "Utah," each of a normal displacement of 21,825 tons. These monsters of the sea will have in their respective complements 60 officers and 954 men. But we have not reached the latest vessels yet. The contracts have already been let for the "Arkansas" and "Wyoming." Remember the "Oregon" of Spanish-American war fame? Well, that is only half a battleship besides these. They displace 26,000 tons each, with a crew of 1,030 men, and 85 officers to command.

The Philadelphia Rapid Transit Company reports that on certain of its lines in that city since the introduction of "pay-as-you-enter" street cars, the number of accidents to persons has decreased 74 per cent. This remarkable change is attributed to the arrangement of closed doors and steps, making it impossible for passengers to get on or off when the cars are moving.

AMERICA'S FIRST AVIATION MEET AT LOS ANGELES

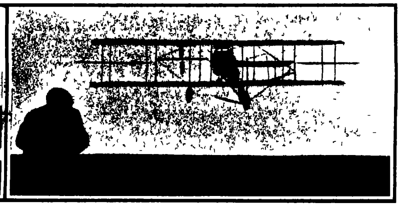
DETAILED ACCOUNT OF THE FLIGHTS MADE BY THE AMERICAN AND FRENCH AVIATORS

The first aviation meeting to be held in this country opened at Los Angeles, Cal., on the 10th instant. Louis Paulhan, the record-breaking French aviator, was present with two Farman biplanes and two Bleriot monoplanes. America was represented by Glenn Curtiss, C. F. Willard, and C. K. Hamilton, all of whom flew Curtiss biplanes. The field that served as an aerodrome was located a few miles from Los Angeles. It was not an ideal place for flying since it was not level. One end of the field was at a considerably higher elevation than the other and the machines were, therefore, obliged to fly quite high in order to pursue a level course. A hexagonal course of 1.61 miles was used. Only a few short flights were made by Messrs. Curtiss and Willard the first day. Messrs. Beachy and Knabenshue, in their dirigible balloons, flew 200 feet above the grand stand against a wind of 10 to 12 miles an hour. Paulhan made his initial flight of 8½ minutes at this time, covering an estimated distance of 4¾ miles. In the second flight he remained aloft 10 minutes. His third flight lasted 29 minutes. He



The two Farman biplanes flying in front of the grand stand.

The Knabenshue and Beachy dirigibles are seen at the right

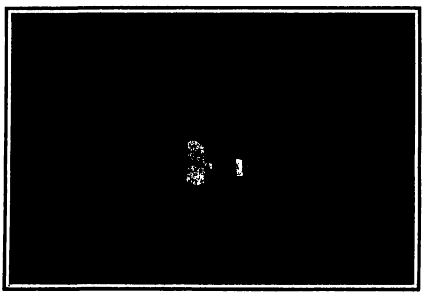


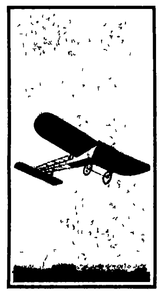
Chas. F. Willard flying in the Curtiss biplane of the Aeronautic Society.

Mr. Willard won the prize for alighting upon a square having 20-foot sides.

Mme. and Mons. Louis Paulhan.

The daring French aviator and his wife hold the record for cross-country flying





The Bleriot monoplane in flight as seen from a balloon.

Making a turn

These two views of the Bleriot monoplane give a good idea of its equally bird like appearance when viewed from above or below. Paulhan flew this machine without difficulty, but his inexperienced assistants met with accidents and broke both machines

Paulhan making his record-breaking high-flight in the Farman biplane. He reached an official height of 4,165 feet

This machine is the most improved type of biplane produced abroad. A single vertical rudder is now fitted between the surfaces of the tail in place of the twin rudders used heretofore. The hinged wing tips for stability are set into the rear edges of the planes. Note also the combined wheels and skids for running on the ground and alighting. One blade of the propeller can be seen below the revolving-cylinder motor at the rear

AEROPLANES AND DIRIGIBLES AT AMERICA'S FIRST AVIATION MEET AT LOS ANGELES, CAL.

sides dashing at the grand stand and just clearing the heads of the spectators, he flew out of sight over the neighboring ranches

On the second day the first flights were made by Paulhan, who took out his new Farman biplane and drove it thrice around the course in a stiff wind, said to be of 18 miles an hour velocity, which was blowing from the sea Next for variety he mounted one of the tiny Bleriot monoplanes, with which Miscarol had been attempting to get off the ground He had no difficulty in flying it in the wind that was blowing Although it bobbed up and down and was tossed about like a small boat on an angry sea Paulhan flew about the field and several times swept past the grand stand, performing various maneuvers and rising to an estimated height of 200 feet The spectators gave a sigh of relief when he finally landed across the field from the stand He was soon out again with his Farman biplane, in which he quickly disappeared from view far to the north Shortly after he reappeared over the trees of a nearby ranch, and frequently charged at the grand stand, turning aside just in time to clear the spectators or else to sweep over their heads This flight of about 8¾ miles lasted 21 minutes and 12 seconds It was the fourth flight he had made on the second day of the meeting After Paulhan's flights, Mr Curtiss brought out his Rheims racer, which is fitted with an 8-cylinder water-cooled motor of 50 horsepower Mr Fancuilli climbed on board with Mr Curtiss, and the machine shot into the air for its speed test with a passenger After describing a wide circle in front of the grand stand Curtiss flew around the course at a speed figured out by Lieut Paul Beck, of the Army Signal Corps—one of the judges—at over forty miles an hour Paulhan immediately started a flight At the same time Messrs Willard and Hamilton started on their Curtiss biplanes in front of the grand stand Curtiss followed them a few moments after with Mr Clifford Harmon as a passenger All four machines were flying at the same time a spectacle well worth seeing Paulhan landed a few minutes later, took on one of his mechanics as a passenger and twice circled the course as readily as he had done alone

Curtiss established a new starting record and also a record for landing but Willard beat Curtiss in the latter respect Curtiss started from a marked square of 400 square feet flew once around the field in something over two minutes and landed exactly on the square from which he started He broke his own record for starting by getting off the ground in 6 2/5 seconds after a run of but 98 feet Paulhan required 12½ seconds time and a run of over 100 feet

The great event of the third day was Paulhan's successful attempt at breaking the world's record for altitude The existing record had been made only six days before by Hubert Latham at Mourmelon, France, with his Antoinette monoplane, and was 3,444 feet Paulhan started in front of the grand stand, and heading north, he went steadily upward in circles until he was nearly a mile high So high did he fly that to the eyes of the onlookers the machine appeared the merest speck in the sky After ascending some 46 minutes, he pointed his biplane once more toward the earth, and came down at a much greater angle and in about one-sixth the time (7½ minutes) The registering barometer on his machine registered 1 525 meters or just over 5,000 feet, so that Paulhan had apparently beaten Latham's record by some 1 500 feet He was given a great ovation upon landing The total length of the flight was 53 minutes 46 1/5 seconds Paulhan's height, as measured from the ground, was officially determined at 4,165 feet.

The fourth day Paulhan gave a good demonstration of the weight-carrying ability of his new Farman machine which is much smaller and weighs 225 pounds less than the regular Farman biplanes, by taking up his two assistants Maisson and Miscarol, and circling several times around the course with them. Curtiss circled the course ten times in 24 minutes 54 2/5 seconds. Paulhan tried to beat this time and failed by five seconds only Previously, he made three laps in 8 16 1/5 carrying his wife as a passenger After circling the field he alighted readily in the marked-off square from which he started In another flight of 7 minutes' duration he carried Mrs Ferris as a passenger. He again resorted to his sensational methods, flying low over the grand stand, making sharp turns, etc Hamilton, Paulhan, Curtiss and Willard qualified in three-lap flights for all events The first named made a flight with his vertical rudder locked, in order to show that this rudder does not have to be used in connection with the balancing planes, as is done by the Wright brothers when they warp the planes of their machine to correct its transverse equilibrium This combined operation of the equilibrium-maintaining device with the vertical rudder is one of the strongest claims in the Wright patent. Where plane warping is employed, it is necessary, in order to prevent the slewing around of the machine, when the plane is warped to a greater angle. With balancing planes like those used by Curtiss, the resistance inserted at one end of the machine is as great as at the other, the consequence being that the vertical rudder does not necessarily have to be used. This flight with the rudder fastened demonstrated very well the difference between the two systems. Mr Willard again flew once around the course and landed in a measured square, thereby winning a prize of $250 Paulhan was presented with a $500 silver cup by enthusiastic citizens of San Diego The next day he made a cross-country flight of some 16 miles to San Pedro and back, circling above the revenue cutters in the harbor and being greeted with cheers by the inhabitants Paulhan also made 6 circuits of the course with his assistant in 18¼ minutes, and afterward flew twice around it alone in the Bleriot monoplane His fastest lap in the latter machine was done in 2 48, which equals a speed of 34 14 miles an hour Curtiss made the fastest lap of the course in 2 12—a speed of 43 45 miles per hour Subsequent to a race with Beachy, Knabenshue made a lap in his dirigible in 5:10 2/5—a rate of 18 4 miles per hour Hamilton tried for the slow lap prize and succeeded in making one circuit of the course in 3 36 2/5– a speed of 26 78 miles an hour The time of Willard's slowest lap was 3 11 1/5 Hamilton made a 12 minute flight for altitude, reaching a height of 530½ feet.

But very little flying was done on the sixth day of the meeting, owing to wind and rain The field was wet and muddy, but notwithstanding this, all the aviators got off the ground without much difficulty and made a few short flights. Paulhan attempted to beat Curtiss' ten lap record, but he was unsuccessful Willard and Hamilton also made an attempt at this record, the latter covering the 16 1 miles in 30 34 3/5 or at an average speed of 31 7 miles an hour Miscarol, Paulhan's assistant, made a brief exhibition flight with a Bleriot monoplane In landing, the machine tipped to one side, causing the wing to strike the ground and break off The accident was blamed upon the substitution for wing warping of the movable ends of the tail, which normally move together and act as the horizontal rudder By moving these ends of the tail in opposite directions, the transverse equilibrium can be maintained fairly well under ordinary conditions, although this method is not so positive as that of warping the wings themselves.

Sunday January 16th, but few flights were made, as the weather still remained inclement. The following day, however, Paulhan attempted to break Farman's record of 4 hours and 17 minutes. After remaining aloft 1 hour, 58 minutes, 37 2/5 seconds, during which time he covered 75 6 miles, Paulhan was obliged to descend on account of a leak in the gasoline tank. He therefore did not come within 2¼ hours of equaling Farman's record Hamilton also flew during some of the time that Paulhan was making his endurance flight. He kept at a lower level and made 11 circuits of the course, but was obliged to stop on account of motor trouble Curtiss lowered his time for ten laps to 23 minutes, 43 2/5 seconds (40.71 miles an hour) His fastest lap was three seconds slower than his best previous circuit. Paulhan covered ten laps in 25 5 1/5. Beachy made one lap in his dirigible in 4:57 4/5 (19 46 miles an hour) This was the fastest lap scored by any dirigible during the meet. The Gill-Dosch biplane, which is very much like the Curtiss, and which was constructed by two gentlemen from Baltimore, Md., made several attempts to get off the ground, but was only successful in making a few short jumps. Mr. Clifford Harmon made a short flight alone in his new Curtiss machine.

Tuesday, January 18th, is noteworthy for the long cross-country flight of Mons. Paulhan, who flew to "Lucky" Baldwin's ranch and back, a distance of about 47½ miles, in 1 hour, 2 minutes, 42 4/5 seconds. In the course of this flight he rose to a height of 2,130 feet, according to the registering barometer carried in the biplane Most of the time he was at a height of between 1,000 and 2,000 feet. During the return journey, which was made in about 23 minutes, Paulhan had to fight against a rather strong westerly wind, and yet he is said to have required only about three minutes more returning than he consumed in flying to the ranch Probably at the elevation at which he was traveling he did not encounter as strong a wind as was blowing near the earth.

January 19th was given up to the making of a number of flights with passengers. The weather was perfect save for a puffy wind in the early afternoon, which later died out altogether About 2:30 P. M Paulhan started on a cross-country flight with his wife as a passenger After circling once around the field he left the course and headed directly toward the ocean. He flew at a height of some 500 feet to Redondo Beach In the course of his flight he passed over several other neighboring seaside resorts. He returned safely after 33¾ minutes, having covered over 20 miles across country without difficulty This flight was twice as long as that made by Orville Wright at Fort Meyer last summer in the speed test for the government It is the longest cross-country flight ever made with a passenger, although it was not by any means as hazardous as the one made by Mr Wright. Other flights were made with Mrs. C F Bishop, Lieut. Paul Beck, W R. Hearst, and a reporter for a New York newspaper For the second time Lieut Beck tried dropping dummy bombs upon a measured square on the ground While he did not succeed in hitting the mark, he came very close to it, and showed the possibility of dynamiting a warship or a town in this way Paulhan's last flight was made with Mr Harmon as a passenger It was a cross-country flight of 8 to 10 miles lasting about 20 minutes. Hamilton made three attempts at high flying, rising to heights of 455, 300, and 700 feet, respectively The Gill Dosch biplane was finally made to fly and was driven once around the field by Hillary Beachy In descending, however, it was badly damaged Curtiss made two laps, but was unsuccessful in breaking his speed record

The last day of the meet, January 20th, Curtiss made the longest flight he has ever accomplished Starting at 3:25 P M, Paulhan had made but two or three laps, when Curtiss went aloft about half a lap behind him Mounted on his Rheims racer, Curtiss steadily gained upon Paulhan, and after making three laps passed him in front of the grand stand, his small biplane flying directly above the larger French machine. This was the first real race the spectators had witnessed, and Curtiss received great applause He continued to fly around the course until he had covered 30 laps (48 3 miles), his time being 1 16 39 Paulhan made 35 circuits of the course (56.35 miles) in 1 34:34 The average speeds of Curtiss and Paulhan were respectively 37 8 and 35 77 miles an hour Hamilton made a flight to Moneta, about 7 miles from the aviation field. He rose to a height of several hundred feet and disappeared from view upon the horizon. Upon his return the crankshaft of his motor broke when he was nearly back, and he succeeded in gliding down to the field and alighting without mishap A feature of the last day was a parade showing the evolution of locomotion. The parade opened with an old-time "prairie schooner" and ended with the aeroplanes.

Prof. J. S. Zerbe's multiplane. This machine is of the following plane type.

A NOVEL AMERICAN AEROPLANE AT THE LOS ANGELES MEET

The Boston Aeronautic Show.

The first Aeronautic Show to be held in America as a separate affair will open in the Mechanics Building, Boston, Mass., the evening of February 23rd. This show will be held under the auspices of the Aero Club of New England, and a number of men well known in the aeronautical world stand sponsors for it. Besides numerous models of aeroplanes, there will be exhibited a number of full-sized representative machines. A duplicate of the United States government's only dirigible balloon will also be on view. Inventors and experimenters having anything to exhibit should communicate at once with the manager of the show, Mr Chester I. Campbell, 5 Park Square, Boston, Mass.

Patent Department

TOOL FOR CUTTING STAY BOLTS.

Stay bolts in locomotive boilers usually break near the inner side of the outside boiler sheet. When the broken bolt is in position behind the frame of the locomotive it is necessary to drill the bolt on the firebox and drop it out of the way, after which a hole is bored

TOOL FOR CUTTING STAY BOLTS.

through the stub in the outside sheet and the part of the bolt remaining is cut out with a round nose chisel. This is difficult to do, and it sometimes happens that the sheet is grooved in the operation, and trouble is caused thereby. With a view to overcoming this difficulty the tool illustrated in the accompanying engraving has been invented. It consists of a cutting member arranged to move in a sheath which can be fitted into the hole drilled in the bolt and serve as a guide for the cutter which is then operated to cut out the bolt. The body of the tool, which is of hexagonal form, is indicated at *A*. Projecting from the body *A* is a blade *B* formed with a bead *C* at its lower edge. The sheath above referred to is indicated at *D* and is formed with a central bore to fit the bead *C* and a slot to receive the flat portion of the blade as indicated in Fig. 2. The sheath *D* is reduced at *E* to form a centering guide. The bolt to be removed is first drilled out, as indicated in Figs. 3 and 4, to the diameter of the part *E* of the sheath. The portion *E* is then fitted into the bore, after which the cutting tool is operated to drive the end *F* of the blade into the bolt and cut it out as indicated in Fig. 1. After the bolt has been cut at three or four points it may easily be knocked out. Mr. William Smith of Peshtigo, Wis., has secured a patent on this new cutting tool.

UTILIZING CENTRIFUGAL FORCE PRACTICALLY.

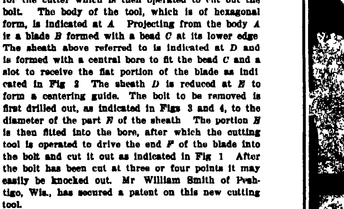
A Danish engineer, resident in New York city, Dr. Albert C. Albertson, has endeavored to turn to practical use the enormous centrifugal force generated by a rotating body. His invention is at present embodied in an actually constructed and operative air compressor, with what success we leave our readers to judge from the accompanying illustration and the following brief description.

In each of two parallel guide frames a block is mounted to reciprocate. Each block is connected with the piston rods of a duplex compressor. Through the blocks an axle runs to the end of which is attached a weight-carrying arm. When the arms are thrown forcibly to one side or the other, each block moves back and forth, because the centrifugal force produced at the weighted end of the arms is endeavoring to carry the weight off at a tangent to the circle from its own center. But the center of each circle is the axle in the respective block. Hence the blocks move outward in their guide frames as the arms are thrown out. The angle bearings, center, arm weight are all therefore constantly changing position so long as the arm is being turned fast enough. Each centrifugal arm in its flight does not describe a circle, but rather an ellipsoidal curve due to the shifting of the block.

The two guide frames, as has been stated, are placed parallel to each other, each having a block, arm, weight, etc. The blocks are held in opposite positions so that the arms will balance each other and so that the two blocks will always reciprocate in opposite directions.

The means employed to hold the centrifugal arms in position, and yet allow them to follow their respective "pulls," consists of a shaft between the guide frames with two crank arms, each of which has a pin extending into a slot cut in each arm. The crank shaft is driven by a small motor. As the cranks turn, the centrifugal arms are turned by the pins which project in the arm-slots. The greater the speed of the crank, the greater the power of the centrifugal arms. Because there is no connection between the centrifugal arms and the cranks, the reciprocating action of the blocks is caused entirely by centrifugal force.

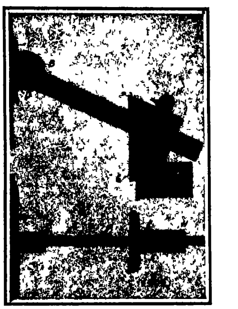
It is a curious though easily comprehensible fact the amount of centrifugal force developed was so great in the machine illustrated that it was necessary to cut away part of the material of each arm and to reduce the weight so that the pistons would not hammer against the cylinder heads.



CENTRIFUGAL MACHINE.

BRACE FOR BRICK KILNS.

During the process of baking bricks the kilns expand and contract, and if the sides are not braced after they have contracted they are apt to topple over if the kiln should expand again. Hitherto it has been the custom to brace the sides of a kiln with timbers and wedges which work involves considerable

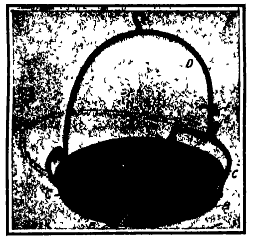


BRACE FOR BRICK KILNS.

danger to the workmen while adjusting the wedges. In order to remove this danger an inventor has recently devised the brace illustrated in the accompanying engraving. It consists of a bar *A* formed with teeth along its upper edge. One end of the bar is provided with a pair of studs adapted to engage a curved slot *B* in a supporting member *C*. The base of the supporting member is made broad so as to provide a large bearing surface. The bar *A* enters a recess in the supporting member and is cut away at *D* so that when the supporting member is pressed against the wall of the kiln the upper edge of the base will dig into the wall, as shown in one of the illustrations. The teeth on the bar *A* are adapted to be engaged by a pawl *E* which is fulcrumed in a member *F* that is supported on a timber disposed along the side of the kiln. The member *F* is held in place by teeth *G*, which dig into the wood. The pawl *E* is provided with a thumb piece *H* by which it may be lifted out of engagement with the ratchet teeth in the bar. In using this brace the workman thrusts the supporting member *C* against the side of the kiln and places the member *F* in position on the timber. Then pressing against the kiln with his foot he takes up the slack between the two members *C* and *F* by engagement of the pawl *E* with the ratchet teeth on the bar *A*. Mr. Anatole Perusse (care of J. McLean, 245 East Strand, Rondout, N. Y.) has just received a patent on this improved brace for brick kilns.

BUTCHERS' SCALE PAN.

It is customary for butchers to weigh meat in large scale pans that are usually provided with a rigid bail which is also of large dimensions, and the fact that the bail is rigidly attached to the pan makes it inconvenient to stow away the pan when it is not in use. The accompanying engraving illustrates an improved form of butcher's scale pan in which the bail is so mounted that it may be folded down against the pan when it is

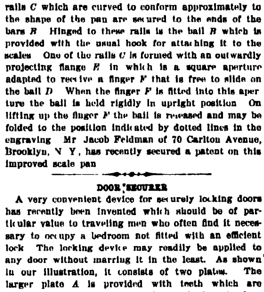


BUTCHERS' SCALE PAN WITH FOLDING BAIL.

not in use, but whenever desired may be locked rigidly in an upright position. The bail is not directly connected with the pan, but to a pair of rails which serve to distribute the strain. In our illustration we have lettered the pan proper *A*. Riveted to the pan at the bottom are a pair of diametrically disposed straps *B* which cross each other at right angles and are bent up at the ends against the sides of the pan. The two rails *C* which are curved to conform approximately to the shape of the pan are secured to the ends of the bars *B*. Hinged to these rails is the bail *D* which is provided with the usual hook for attaching it to the scales. One of the rails *C* is formed with an outwardly projecting flange *E* in which is a square aperture adapted to receive a finger *F* that is free to slide on the bail *D*. When the finger *F* is fitted into this aperture the bail is held rigidly in upright position. On lifting up the finger *F* the bail is released and may be folded to the position indicated by dotted lines in the engraving. Mr. Jacob Feldman of 70 Carlton Avenue, Brooklyn, N. Y., has recently secured a patent on this improved scale pan.

DOOR SECURER.

A very convenient device for securely locking doors has recently been invented which should be of particular value to traveling men who often find it necessary to occupy a bedroom not fitted with an efficient lock. The locking device may readily be applied to any door without marring it in the least. As shown in our illustration, it consists of two plates. The larger plate *A* is provided with teeth which are placed against the jamb of the door and when the door is closed on the plate it forces these teeth into the wood. The opposite end of the plate *A* is turned back upon itself to form a bearing *C* the purpose of which will presently be explained. A square opening *D* is cut through the body of the plate *A* and adjacent to this opening a cam or eccentrically mounted disk *E* is provided. The second plate, as shown in Fig. 3, is formed with bearings *F* adapted to fit at opposite sides of the bearing *C* and receive a screw that passes through the bearings of both plates, being threaded into one of the bearings *F*. The smaller plate is also provided with a lug *G* which projects through the open

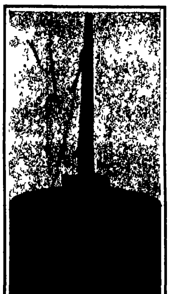


SIMPLE DEVICE FOR SECURING DOORS.

ing *D* in the plate *A*. The lug *G* is recessed to receive the cam *E*, and the latter is turned to press the step *H* against the door and thus lock it shut. In order to allow for the movement of the smaller plate as the cam *E* is turned the bearing *C* of the larger plate is elongated as shown in the drawing. The inventor of this door securer is Mr Charles W Lent of Tingley, Iowa.

AN OIL CAN

The oil can illustrated in the accompanying engraving belongs to the class embodying a flexible bottom which is operable to cause a flow of oil. The construction here shown, however, is arranged to provide a considerably greater flow of oil than is obtainable in cans of the conventional construction. This result is secured by providing three diaphragms in the can, one of which serves as the bottom of the can, while the other two are connected at the center by a nipple. In this manner an oil chamber separate from the main portion of the can is formed. In the accompanying engraving the can is shown at *A* with the usual nozzle *B* threaded into the upper end. Fitted into the lower end of the can is a retaining ring *C* which has extending flanges at the upper and lower ends and is also bent outwardly at the lower end to fit against a shoulder formed in the can body. The dished diaphragms *D* and *E* bear against the flanges of the retaining ring. The two diaphragms *D* and *E* are connected at the center by the nipple *G*. The diaphragm or bottom *F* is soldered fast to the can body. An oil chamber is thus formed between diaphragms *F* and *E*. In operation when the bottom of the can is pressed inward it drives the oil from the oil chamber with greater pressure than would be the case if the entire can body formed a single oil vessel. At the same time

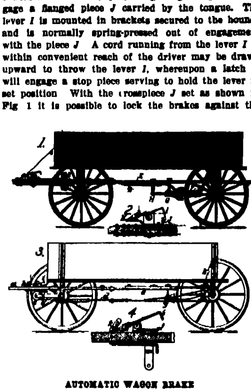


TRIPLE-BOTTOMED OIL CAN.

the other two diaphragms yield as well, thus effecting a large discharge of oil. Mr Frederick G Svetlik of Cadott, Wis, has recently secured a patent on this improved oil can.

AUTOMATIC WAGON BRAKE.

Two patents have recently been issued on the subject of wagon brakes, describing a form of brake for use on carriages and wagons, that will be automatically applied when the horse is checked or presses back against the load when going down hill. The brake may also be applied by hand and can be thrown out of automatic operation whenever it is desired to back the vehicle. In order to take off the strain upon the mechanism when traveling around curves or over rough roads, a flexible connection is made between the tongue and the brake mechanism. In Fig 1 the tongue is indicated at *A*. It is provided with a crowned roller *B* mounted on a vertical axis which bears against a crown roller *C* mounted on a horizontal axis. The roller *C* is carried between two arms of a brake reach *D* which are disposed at each side of the main reach *E* and are free to slide longitudinally in the hounds. The brake reach *D* is connected at the rear end to a lever *F* which is connected by chains to the brake beam *G*. The latter carries the brake shoes that bear against the rear wheels of the vehicle. The brake beam is connected by a spring to a post *H* carried by the main reach *E*. It will be evident that when the tongue is pressed backward or when the vehicle rides forward on the tongue the brake reach will throw the lever *F* backward, drawing the brake shoes into engagement with the rear wheels. A hand lever extends upward from the lever *F* to permit of operating the brakes manually. In order to throw the automatic mechanism out of operation the tongue *A* is locked to the hounds by means of a simple mechanism. It consists of a lever *I* with a downwardly projecting flange adapted to engage a flanged piece *J* carried by the tongue. The lever *I* is mounted in brackets secured to the hounds and is normally spring-pressed out of engagement with the piece *J*. A cord running from the lever *I* to within convenient reach of the driver may be drawn upward to throw the lever *I*, whereupon a latch *K* will engage a stop piece serving to hold the lever in set position. With the crosspiece *J* set as shown in Fig 1 it is possible to lock the brakes against the



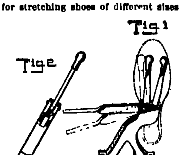
AUTOMATIC WAGON BRAKE

wheels, while if the piece *J* is set with the flange at the opposite side, as shown in Fig 2, it serves merely to lock the tongue to the hounds in such position that it cannot set the brakes.

The second construction referred to is similar to that shown in Fig 1, and corresponding parts are referred to by the same, but lower-case, letters. The tongue *a* is connected to the brake reach *d* by means of a chain *b* which passes over a pulley *c*. The brake reach *d* is connected to a lever *f* which in turn is connected by means of chains to the brake beam *g*. The brake beam is connected by a link to the main reach *e*, and is held in inoperative position by a spring attached to the brake reach *d*. The hand lever for operating the brake is shown at *h*. A locking device similar to that shown in Fig. 2 is indicated in Fig 4 comprising a lever *i* mounted on the hounds, a lug *j* mounted on the tongue and a latch *k*. The inventor of these wagon brakes is Mr Eben G Dolan of Starksboro, Vt.

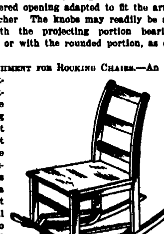
ODDITIES IN INVENTIONS

Improved Shoe Stretcher.—The shoe stretcher illustrated herewith is so arranged that it may be adjusted for stretching shoes of different sizes and shapes, and for applying the pressure at any point desired so as to stretch the shoes to a comfortable fit. The stretcher is provided with a stationary base, formed with an arm at its upper end, which terminates in a knob. Fulcrumed in the base is a bell-crank lever, one arm of which is also provided with a knob, mating that of the fixed arm. By depressing the bell-crank lever, the knobs will be forced apart, stretching the shoe at the points of contact. These knobs are removable, and are provided at one side rounded and the other projecting. Each knob also has a square tapered opening adapted to fit the arms of the shoe stretcher. The knobs may readily be applied, either with the projecting portion bearing against the shoe, or with the rounded portion, as desired.



IMPROVED SHOE STRETCHER.

Rocking Attachment for Rocking Chairs.—An inventor has recently procured a patent on a device for rocking chairs, without placing the feet on the floor. The particular advantage of this scheme is that a slight movement of the feet will cause the chair to rock. Fulcrumed to the rockers are a pair of levers fitted with rollers at one end to engage the floor, at the opposite end connected by means of links to a pair of bell-crank levers forming a sort of a treadle, on which the operator's feet are supported. By pressing this treadle downward, pressure will be brought to bear on the rollers, causing the chair to rock. When desired, the mechanism may be thrown out of operation by folding the treadle up against one of the cross pieces of the chair.



ROCKING CHAIR ATTACHMENT.

Doctoring Oriental Rugs.

Of the hundreds of thousands of dollars worth of Oriental rugs brought into the United States annually, many of them are what is known to the profession as "washed rugs." This means that brightly colored Oriental rugs are sometimes washed with a solution of chloride of lime, a treatment which partly bleaches the colors and imparts a soft appearance to the rug. The chemical treatment is a process of washing which produces the effect of age and a peculiar sheen to the surface, which is pointed out by many dealers as a proof of superior quality. The fact is, however, that the process of washing invariably weakens and in some instances destroys the materials of the rug. The progressive effect of the chemical treatment of the rug is this. The chlorine gas contained in the chloride of lime attracts oxygen and moisture from the air, by which muriatic acid is formed. This eats away the vitals of the fabric. Sooner or later the wool and cotton in the rug become brittle, and thus weaken the warp and deteriorate the wool. When this deterioration is complete, the pile of the rug may be swept away by the ordinary process of sweeping, and the warp, which is the foundation of the rug, becomes so weak that holes appear here and there, and soon the rug is worthless.

It not seldom happens that a Persian rug is too glaring in some bright hue, perhaps red, and is not salable. An unscrupulous dealer will subject the rug to the series of washings in chemically prepared water. In this way he turns out a rug possessing a soft antique sheen that is truly captivating, and finds a ready purchaser for the doctored floor covering.

A New Comet Discovered in South Africa.

A new comet visible to the naked eye was discovered at Johannesburg on January 16th by Innes, in right ascension 19 hours, 50 minutes, 28 seconds and declination minus 23 degrees, 59 minutes 24 seconds.

At the time of its discovery the comet had an hourly motion in right ascension of plus 41 seconds of time and declination of plus 6 minutes 4 seconds of arc.

The comet discovered is brighter than Venus. At Lick Observatory it was easily seen with the naked eye at noon about four degrees east of the sun and one-half degree north of it, moving northeast.

For a few nights the comet was a brilliant object in the clear southwestern sky just after sunset.

Readers of the Scientific American will hardly confuse this comet with Halley's, which has been the object of constant study since September 11th, when it was sighted. The South African body is one of the two or three comets which are usually discovered every year.

Dr Joseph E. Pogue who is in charge of the Division of Mineralogy in the U S. National Museum, has recently described in the Smithsonian Miscellaneous Collections a remarkable specimen of pyrite studded with crystals of gold and partly covered with plates of galena from the Snettisham district near Juneau, southeast Alaska. The pyrite is in the usual form of a cube, but what is very remarkable is that there are on it more than one hundred and thirty well-defined crystals of metallic gold. These are also in the cubical system and from one-third to one-half buried in the pyrite, never more, and seem to have no definite relation to the crystallization of the pyrite. Similarly, crystals of galena and chalcopyrite are found on the pyrite. The structure and relation of the galena to the pyrite is of considerable scientific interest and is described in technical detail by the author. This very unusual occurrence of these minerals in crystallographic juxtaposition is described by Dr Pogue as follows: "The pyrite, when its present size was nearly attained, sustained a deposition of crystallized gold upon its surface followed by the precipitation of a small amount of chalcopyrite which, in turn, was succeeded by the formation of the galena. A further slight accretion of pyrite completed the development of the specimen."

Failure of a fly-wheel, says Power and the Engineer, usually begins by the starting of a minute crack on the under surface of the rim at the point of greatest stress, viz, near the ends of the arms adjacent to the rim joint. The cracks gradually deepen until failure occurs, with all its disastrous consequences. These minute cracks are visible to an experienced eye, and careful inspection will aid materially in the prevention of fly-wheel explosions.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

STORAGE BATTERY.—P. M. MARKO, New York, N. Y. In this case the invention refers to improvements in storage batteries, and more particularly to means whereby the strength of the battery may readily be ascertained without the aid of outside instruments, attachments, or connections. The electric meter is constructed to specially adapt it to the battery and need have a range of only the capacity of the battery.

ELECTRICALLY-OPERATED HAMMER.—L. PAULSEO, Petersburg, Va. The present invention relates to hammers of the type referred to in a former patent granted to Mr. Paulsro. It contemplates means for maintaining various parts cooled while in action under conditions wherein such parts are usually heated. It also provides means for improving the adjustment of the stroke of the hammer.

ELECTRICAL-FUSE BLOCK.—A. A. MOFFITT and G. E. ANDREWS, Providence, R. I. In this case the invention relates to fuse blocks and fuses to be used in connection therewith, the more particular purpose being to so adjust the fuses relatively to the fuse block, as to prevent the insertion in a particular block of a fuse built for greater amperage than one intended to be inserted in said block.

KEYBOARD-OPERATING MECHANISM.—H. KNUDSEN and H. BARTA, 14 Cyril Mansions, Battersea Park, London, England. This invention relates to a system of type-setting by wireless means which can be attached to or worked in combination with linotype machines or those of similar construction and relates particularly to means for the operation of type-setting apparatus of the type in which parts are synchronously moved in the transmitting and receiving machines so that when a contact is made in the former a corresponding one is made in the receiving machines.

Of Interest to Farmers.

PLOW.—J. COLOMÉ, Caracas, Venezuela. The purpose of the inventor is to provide an improvement upon the old Arabian plow still widely used in the Spanish republics, whereby to render the said type of plow more efficacious without complicating its construction and to better adapt it for use in mountainous districts.

PRUNING IMPLEMENT.—A. H. BASTIAN, Bellwood, Ore. In use an operator takes hold of the pole with one hand and the runner sleeve with the other, which will enable him to hook the fixed blade upon a limb or branch to be removed whereupon a downward sliding movement of the sleeve will rock a lever downward and forcibly rock a blade so that its convex cutting edge will impinge upon the limb and sever it. Means provide for restoring the blades for renewed service.

COTTON CHECKER AND CULTIVATOR.—R. HAMILTON, Gouldbusk, Texas. An object here is to provide a device by means of which the width of the hills or rows may be adjusted to suit the requirements of various grades of soil. Further, to provide means by which the plows of the cultivator may be simultaneously raised or lowered, and when so may be kept in their adjusted positions. Mr. Hamilton has invented another checker and cultivator for use in simultaneously raising and lowering a plurality of plows in a cultivator and means for simultaneously turning a plurality of disk cutters.

JOINTER ATTACHMENT FOR PLOWS.—P. S. SIDELL, Shreve, Ohio. Means are provided for detachably connecting a single or double pointed jointer blade directly upon the standard of the plow share and near to the mold board forming an upward extension thereof which will cut off vines, shear cut sod, and turn such cut material as well as loose soil into the furrow formed by the progressive movement of the board and plow share.

COTTON HARVESTER.—D. H. MAYS, Benoit, Miss. The harvester is adapted for gathering cotton from the maturing plants and for separating the same from foreign substances which are gathered therewith. In gathering cotton, it effects the operation without injuring the plants and leaves them in the same condition as before the cotton is gathered.

BALING-PRESS.—J. O. KELLERBERY, Upper Sandusky, Ohio. Among the principal objects in view are to provide a mechanism for pressing hay or like substances by successive steps and with maximum pressure, a mechanism wherein the return of pressure mechanism to the receiving position is rapid, means whereby the material being handled by the device is fed in unison with the pressure mechanism, and means whereby the pressure mechanism is positively returned to its initial position.

Of General Interest.

MOISTENER.—J. H. BORDEAUX, Joliet, Ill. In the present patent the invention is an improvement for moisteners for labels, envelopes, stamps and other gummed surfaces, and it is designed as either a desk or pocket article, in which capacity it is intended to be both sanitary and leak-proof.

LUBRICATOR FOR CABLES.—W. F. SLAUGHTER, Republic, Mich. In the traverse of cables employed for the draft of cars and general haulage purposes in mines and other places, it frequently occurs that cables are unduly worn from frictional contact with each other if they cross or with supporting means such as pulleys or the like. The device automatically coats a running cable with a lubricant and removes any excess, thus preventing injurious wear or rusting of a wire cable.

HORSESHOE.—B. C. MARKS, Trenton, N. J. The object here is to provide a shoe arranged to securely hold the calks in position without danger of the calks becoming accidentally loose while the shoe is in use to allow of conveniently removing the calks for sharpening, the renewal or exchange of calks for summer or winter wear and without requiring the removal of the shoe from the hoof.

MANDOLIN.—A. MANNELLO, New York, N. Y. In this instance the tone of the instrument and its clear and distinct notes are improved by constructing the body of two cases, an inner and outer respectively, both cases being substantially the same shape and spaced from each other at both the sides and bottom, the inner case preferably having a number of openings in the bottom for the escape of the sound waves.

SNOW MELTING APPARATUS.—M. JONASSON, New York, N. Y. This invention pertains to improvements in means for melting and disposing of snow accumulating on sidewalks and in streets, and the aim is to so construct the apparatus that the water resulting from the melting may be delivered to a higher elevation in the building than the snow receiver.

CARRIER.—J. C. H. GERST, JR., St. Paul, Minn. This device is especially adapted for removing litter and the like from stables, the carrier consisting of a fixed portion which is adapted to take the place of the ordinary gutter at the rear of the stalls, and an elevator proper for receiving the litter from the fixed or horizontal portion and depositing it in a pile remote from the stalls.

FEED BAG.—H. B. DROSIN, A. DROSIN, and L. DROSIN, New York, N. Y. It is the purpose of this invention to provide a feed bag in which the sides at all times remain stretched out or are non-collapsible in a vertical direction, a bail to suspend the bag from the animal's head and springs compressed by the weight of the feed in the bag and varying the effective length of the bail.

YARN.—W. P. WOOD, Pawtucket, R. I. This inventor provides a spun or twisted yarn adapted to be used in the manufacture of fabrics having irregular uneven surfaces, and more particularly provides a yarn spun from cotton or other fiber which when used as a filling will give to the fabric substantially the rough and uneven appearance characteristic of rough pongee fabrics.

DEVICE FOR SPINNING GLASS.—I. WEISKOPF, Morchenstern, Austria-Hungary. The advantages in this case consist in arranging an optional number of means beside one another whereby the output which is possible for one workman is considerably increased. The most important is the use of a fusing point, whereby a small harbor is provided for the fusing glass by which the temperature can be gradually increased up to the melting point of the glass, and dropping of the latter and breaking of the filament caused thereby are prevented.

METALLIC MOLD.—H. G. LASSELLER, New York, N. Y. The purpose of this inventor is to provide a mold for use in building houses and other structures of concrete or other cementitious and like plastic material, the mold being made in sections capable of being set up and removably connected with each other to allow the use of the mold for a great variety of work.

REINFORCED PARTITION WALL.—E. FLAGG, New York, N. Y. The invention concerns itself especially with the mounting and supporting the wire and with means for rendering the wire taut before the plaster or cement is applied. Partition walls when constructed upon studding have a considerable thickness and in this way considerable floor space is lost. The wall in this invention can be made very thin and will give a consequent saving in floor space.

PRESSURE-REGULATOR.—J. KENLON, New York, N. Y. The intention here is to produce a regulator to be connected with the hose, and which operates to prevent the bursting of the hose and injury to the men. It will enable the stream passing to the hose to be reduced and regulated when desired or will enable the full force of the stream to flow unobstructed through the hose.

BOTTLE LABEL.—I. LEVI, Anniston, Ala. As the liquid is poured from the bottle a ring will sink following the liquid, this sinking movement being permitted by prongs. Should, however, an attempt be made to refill the bottle, the prongs will prevent the upward movement of the ring, which consequently will be submerged beneath the fluid, thus indicating that the bottle has been partially refilled.

VALVE FOR IRRIGATING SYSTEMS.—J. LANG, Clearmont, Wyo. The purpose of the valve is to control delivery of water into the laterals. It is so constructed that the valve proper may be raised so as to allow a restricted, or free flow of water into a lateral. The valve is not only for vertical adjustment, which is effected by means of a screw shaft, but also to be swung laterally when it is required to uncover the water inlet or opening to the fullest extent.

SYRINGE.—T. R. MCNERTHNEY, Tacoma, Wash. By the action of gravity and the production of a partial vacuum the combined douche and syringe effect a thorough but gentle embrocation of diseased walls of the "os" and parts with a medicinal liquid and then remove the medicament together with pus and other secretions, by a free liquid irrigation of the diseased tissue. It is also serviceable for use in the ear, nose or other diseased cavities of the body.

Hardware and Tools.

FILTER.—H. P. STRAIN, Cleveland, Ohio. An object of the inventor is to provide a durable filter for filtering air or other fluids with which, filter material of different kinds can be employed, in which the filter material is securely held in place by adjustable caps and in which the casing has a head forming a lock nut for one of the caps.

SPECIFIC GRAVITY BALANCE.—B. R. JOLLY, Raleigh, N. C. In carrying out this invention Mr. Jolly provides a scale by which the object to be assayed may be first balanced in air and then in water by moving the weight farther from the pivot or center of the balance beam. The quality or fineness of the substance may then be determined immediately by means of a scale which is rotated until it reaches a stop, when the reading may be taken directly.

PLIERS.—C. R. COLSINO, Crescent City, Cal. The principal objects in this case are to provide a construction for pliers wherein the clamping jaws are pivotally mounted to operate in substantially parallel lines in closing, to provide a simple and efficient form of construction, and to provide a construction wherein the parts are readily separable for repair or substitution.

SQUARE OR GAGING DEVICE.—J. T. BLAIR, Tulsa, Okla. In this case the invention pertains to a device the purpose of which is to facilitate the laying out of carpenters' work or similar work, and the purpose is to provide a device by means of which the length and angle of the rafters, hips and valleys of roofs may be readily ascertained.

NUT LOCK.—J. MCILWAIN, Okawville, Ill. In the present patent the invention refers to certain improvements in nut locks and more particularly to that type of nut lock in which a retainer of wire or the like engages within grooves, openings or apertures in the nut to prevent the latter from turning.

KEY FASTENER.—C. O. SHAIR, Smithfield, W. Va. The invention relates to key fasteners, and more particularly to such as are adapted to prevent the accidental displacement of a key positioned in a lock and each of which in general includes a stop and means for operatively disposing the stop in a predetermined position to bar the key-hole and prevent the withdrawal of the key.

FASTENER FOR STORM WINDOWS AND WINDOW SCREENS.—J. MICHAELSON, Peterson, Minn. The aim of this inventor is the provision of a device which is convenient to apply to a window casement and is adapted for reliably holding a storm window or a screen in place within a window casement, on the inner side thereof and permit the extra window or screen to be quickly detached from the casement.

FLUE CUTTER.—W. H. DAMON, New York, N. Y. The invention belongs to that class of a cutter in which a mandrel to fit within the flue is provided with an eccentrically arranged tool carrying shaft having a limited relative rotary movement to project and withdraw the tool. It is a cutter in which the mandrel has a yoke head and a shaft provided with a thumb controlled member rigid with the shaft and arranged between the arms of the head.

Heating and Lighting.

LAMP.—C. M. DANIELS, Paris, Ill. Mr. Daniels supports the mixing tube and burner directly from the fuel supply pipe or vaporizing chamber in such a way that the mixing tube and burner may be readily removed. The burner itself is removable from the mixing tube, the construction of the burner and the means for supporting it, constituting another feature of his invention.

SAFETY ATTACHMENT FOR GAS LIGHTING BURNERS.—H. E. CAMPBELL, New Haven, Conn. The principal objects in view are to provide an attachment wherein the heat of the flame maintains the flow of gas, to provide an operating medium which will not become frozen or lost by evaporation and to provide a construction simple and efficient in its operation.

FURNACE-GRATE OPERATING MECHANISM.—H. BEVAN, Burlington, N. J. The grate is depressible from the bottom of the fire-box to empty the latter and provide space for the insertion of a gas ring, as in the spring and fall when heating the house for a portion of the day. The invention further contemplates locking of the grate when raised and the locking of the grate shaking means when the grate is depressed, to provide a fixed rest on which the gas ring may be slid to position of use.

WATER TUBE BOILER.—W. S. LUCAS, Marshall, Ill. The intention of the inventor is to provide a boiler designed for use in generating steam for motive power or for heating buildings by steam or hot water and arranged to provide an exceedingly large heating surface and to use the fuel economically and to the fullest advantage.

AUTOMATIC CUT-OFF FOR GAS MAINS.—C. E. LAHMERS, New Philadelphia, Ohio. This device is for use in preventing explosions or accidents caused by the changes in the pressure in gas mains. One object of the invention is to provide a device which will automatically shut off the flow of gas from the mains when the pressure therein becomes too low thereby preventing the accidents which otherwise might occur.

GAS-FIXTURE.—A. JARMOLOWSKY, New York, N. Y. In view in this present invention is a construction in which the lighter, as it is revolved moves the controlling valve to turn on the gas to the several lights or burners in successive order the flow of gas in each burner starting at the time the burner is reached by the lighter. It is an improvement on a former patent granted to Mr. Jarmolowsky.

Household Utilities.

AUTOMATIC DAMPER-OPERATING DEVICE.—F. H. MULLER, Lansdale, Pa. This invention provides novel means for simultaneously operating the dampers of a cooking stove or range at a predetermined time, so as to start a smoldering fire therein into free burning condition and means for sounding an alarm at the same time the dampers in the range are adjusted to produce free draft therein.

JAR HOLDER.—O. F. PETERSON, Keokuk, Iowa. The aim of the invention is to provide a device serviceable in construction and inexpensive to manufacture which can be easily mounted on a receptacle such as a pan or the like, and which serves to hold a number of preserve jars in place while the latter are being filled.

BRACKET FOR SUPPORTING CURTAIN POLES AND SHADE ROLLERS.—A. S. DAWSON, Springfield, Ill. Brackets have been constructed which support poles and rollers so that they combine two functions, but they have been made of so many parts and otherwise constructed in such manner as to be comparatively expensive and unsatisfactory. In the present bracket all the parts save the hook which serves to support one end of the roller and the rod and spring are formed integrally or in one piece and may, therefore be produced at minimum cost.

WASHING MACHINE ATTACHMENT FOR STATIONARY WASHTUBS.—W. WALTON, JR., New York, N. Y. The invention is an attachment for tubs, and is designed to provide a washing apparatus embodying a washing cylinder which may be readily applied to and operated in stationary tubs of various sizes, and the cylinder easily removed when desired to use the tub in the usual manner.

MATTING ROLLER.—A. F. SHANNON, Columbus, Ohio. Matting is comparatively stiff and has a slippery surface difficult to roll upon a bar or spindle. This inventor has attained success with the present invention that is to say with a bar or spindle formed of spring material and having a lengthwise slot in which a block is inserted and permanently held and serves to separate the halves of the spindle more widely than normally.

AWNING FIXTURE.—J. SULLIVAN, New York, N. Y. A purpose here is to provide a fixture one which will obviate the necessity of attaching the upper portion of the fixture to the window casement and one wherein a person standing on the window sill or operating from a suitable point in the room, may conveniently and almost in a moment place the awning in position for immediate use.

WASHING MACHINE CYLINDER.—J. R. GOLTER, Greensboro, N. C. In this machine the brace ribs operate to strengthen and support the perforated jet ribs. The latter tend to cause the water to pass through the perforations with force as the cylinder revolves in the water thereby making it easier to mix the washing ingredients with the water and facilitating such mixing and the washing process.

Machines and Mechanical Devices.

LOG HANDLING DEVICE.—J. G. STONER, Smithsburg, Md. The object here is to provide a device for use in connection with saw mill carriages and the like which can be arranged adjacent to the carriage to assist in turning the log by means of a cant hook or similar device and which prevents the possibility of the log being displaced from the carriage while it is being turned.

BRAKE LEVER MECHANISM FOR CARTS AND WAGONS.—G. MANLOVE, Rushville, Ill. More particularly the invention concerns itself with that form of brake lever mechanism which comprises a segment with which a lever co-operates by means of a pawl so that the pawl will hold the brakes applied when the lever is thrown over to the braking position.

STUMP EXTRACTOR.—A. P. BERNIN and E. J. WARR, Portland, Ore. This machine extracts stumps or similar obstructions from the ground. The object of the invention is to provide a machine which is simple in construction, having means whereby the device

may be anchored and improved means for attachment to a stump or other obstruction which is to be removed

ROCK DRILL.—L. F Sleade, Denver, Colo., and W A Sherwood Courtland Ariz In the present patent the improvement relates to drills the more particular purpose being the provision of a type of drill especially suitable for work in rock and similar hard substances and possessing a number of constructional advantages whereby its utility is greatly increased

MACHINE FOR MAKING COMPOSITE FABRIC —F Strauss and W B Fenkins, New York N Y An object here is to provide means for delivering a plurality of layers of material under proper tension to an assembling and folding device Further to provide means for delivering a plurality of layers of material to a compressing device in a peculiarly assembled relation and under a proper tension

BRISTLE DRYING MACHINE F R. Zeunke Toledo Ohio The intention in this case is to produce a machine which can treat a large quantity of bristles and which operates in connection with a drying current of hot air The bristles are treated in such a way that they are turned over and over so that they become uniformly exposed to the heat during the drying process

PNEUMATIC RELAY FOR AUTOMATIC MUSICAL INSTRUMENTS A W Lonsdale 24 Woburn road Bedford England The invention relates more particularly to relays such as are commonly employed in the "actions" of automatic piano-players and similar instruments or adjuncts thereto The feature consists in the fact of the secondary valve being so mounted and guided as to be completely free to seat itself fairly upon the surfaces with which it alternately makes joint.

BREAKING OR GRANULATING MACHINE. J H Spencer, New York N Y For the purpose of granulating or breaking the meat of nuts and other material without bruising or crushing use is made of stationary spaced jaws, and movable jaws adapted to pass between adjacent fixed jaws, said fixed and movable jaws having tapering sides and the wider faces of the fixed jaws being uppermost and the wider of the others being lowermost at their passage between the fixed jaws

TYPE WRITER ATTACHMENT - D F Maher Watsonville Cal It is sometimes desirable to dictate directly to the typewriter so that the letter may be written at once without the intervention of a stenographer In so dictating much time is lost by the one dictating and the operator and Mr Maher seeks to devise a simple alarm device whereby the operator may indicate to the dictator when the latter may proceed with the dictation

TYPE WRITER STAND C F Goulding Tampa, Fla The objects here are to provide means whereby heavy records may be held in view of the operator while operating means whereby the pages may be secured or clamped in flat position upon the copy holder means whereby successive lines may be accurately followed by the operator and means whereby the heavy and cumbersome record may be shifted easily

MECHANICAL MOVEMENT — F L. Bowies, Jersey City N J The movement is of special value in connection with flying rowing, and exercising machines and in various other relations wherein it is desirable to cause a reciprocating member to feather in an arbitrary manner for the purpose of producing an efficient stroke

CLUTCH —W E Knoell, Minneapolis Minn This clutch will automatically release at the first revolution of the shaft after engagement The invention is particularly adapted for use in the class of machines wherein a single rotation of the driving pulley is desired, and wherein the timing of such rotation is manually controlled

HANDLING MACHINE FOR BASKETS. F L. Harrell Jacksonville Texas This simple machine will operate automatically to feed in the wire stock cut the wire to the proper length and form it into a handle The machine then operates to attach the handle to the basket and clenches it in position

GAGE FOR DETERMINING THE VELOCITY OF FLUIDS—F H Crawford and M B Carmody Columbus Ohio The velocity of fluid may be ascertained with a knowledge of the statical pressure in one half of the gage by determining the variation of the levels in the two halves of the gage which is readily determined by examination of a dial over which travels a hand which is secured to the gearing A scale and glass tube are also provided for use when placing the fluids in the lower portion of the gage

PROPELLER —F C Gordon Cleveland, Ohio In this propeller the blades are reversible so that the shaft while turning continuously in one direction may be made to turn the vessel ahead or astern as desired The invention provides a casing for the blades the casing constituting not only a protective and returning part but a bearing part as well It is an improvement over a similar device in a patent formerly granted to Mr Gordon

BEER DISPENSING APPARATUS.—W A Wentzell, New Albany Ind One of the objects of this improvement is to provide a device by which the manipulation of simple mechanism may cause the return of beer to the kegs, the cleaning of the coils, pipes and faucets and the draining of these parts, thereby leaving the apparatus clean and ready for subsequent use

ROAD WORKING MACHINE.—E. B. Winters, Coffeyville Kan The invention pertains more particularly to such machines as are used for grading roads, and which include substantially parallel beams carrying scraper blades adapted to engage the road surface, and means whereby the pitch of the blades may be adjusted to alter the depth to which they shall sink into the road surface

BUSH HAMMER.—J H Sweetland, Hall Quarry Maine The inventor's aim is to provide means to more securely hold the teeth or blades in the head of the hammer, so that any lateral movement of the teeth or blades may be prevented while at the same time it is possible to replace the teeth cutter with little trouble

Prime Movers and Their Accessories.

CONDENSER PUMP - P J Penninger Kiel Germany According to the invention the pressure chamber of the pump for the water of condensation is adapted to take up the air primarily compressed in the air pump and to raise the pressure of said air to that of the atmosphere The pump used for the water of condensation is of the single acting type

Railways and Their Accessories.

SAFETY DEVICE FOR RAILROAD FROGS —J T Watson, Osage City Kan This device is adapted to prevent a person walking on the railroad from catching his foot in a frog on the track, thus preventing the numerous accidents due to persons wedging their feet between the rails and being unable to extricate themselves before being run down by fast moving trains

RAILWAY TIE AND RAIL.—I J Gray, Lawrence Kan This invention relates to railway ties and the object of the inventor is to produce a tie which is particularly adapted to be formed of metal and to provide a special construction of rail which facilitates its attachment to the tie A further object is to provide special means for insuring that the tie will keep its shape The railway ties constructed as intended can be readily formed from light sheet metal

CAR MOVER F C Bailey Rib Lake, Wis The object here is to provide a device which is simple and serviceable in construction and inexpensive to manufacture which will automatically clamp itself on a rail to give a firm support for the lever as the latter is operated to advance a car along the tracks

SIGNAL R C Brook Hastings Colo An object of this inventor is to provide a railroad signal which can be removably mounted upon railroad locomotives cars or the like or on or near the railroad track which can be reversed to present a different appearance or color, which can be easily cleaned when soiled, and which can be manipulated rapidly and easily

MINE CAR WHEEL. J T Parks and M T Davis, Jr, Charleston, W Va The main purpose of the present invention is to make use of a plug for holding the wheel on the shaft, with improvements for loosening the plug if the latter should become jammed against the shaft Further to provide a plug for keeping the hub on the wheel which is not subject to the danger of rotating out of place, but which is held in place by means of an extension

MERCHANDISE-TRANSFER SYSTEM.—G Macartney St Paul Minn Generally speaking the invention consists of one or more unloading platforms, with one or more railroad tracks located adjacent thereto and a plurality of loading platforms with tracks adjacent thereto and with interconnecting tracks adjacent to said loading and unloading platforms the relative heights of the railroad and miniature railroad tracks and platforms being so arranged that the floors of the cars on the various tracks will extend in substantially the same level as the floors of the adjacent platform

RAIL CONNECTION.—H Grass, Alvin, Texas, It is the usual practice to connect the meeting ends of rails by means of heavy fish-plates and screw bolts leaving such ends otherwise entirely unsupported between adjacent cross ties. The object of the inventor is to prevent certain results due to the above and other arrangements of imperfect and objectionable connections between rail ends and the lack of due support therefor

ELECTRIC CONDUCTOR FOR RAILWAYS.—E W Enequist, New York, N Y Primarily the object here is to provide in connection with one or both of the traffic rails of an electric railway i e one of the rails on which the rolling stock travels as contradistinguished from other rails an electric conductor or conductors for feeding the car motor, thus dispensing with the usual third rail or overhead wire conductor and avoiding many of the dangers and inconveniences resulting therefrom

JOURNAL-BOX LID FASTENER.—T H Joye, Charleston S C The improvement is in boxes for railroad stock, and resides in the construction of the lid and the parts of the body co-operative therewith to lock the lid in closed position, limit its sliding movement in the opening of the box, force the lid when closed, in a direction to bind the lid to the box body, and when open to frictionally retain the lid in an open position, and in constructing the box so that the locking means can be disengaged only by a special key

Pertaining to Vehicles.

VEHICLE BRAKE.—F A Eichenmann, Newark, Ohio The aim in this case is to provide a brake for use in connection with motor vehicles and the like, by means of which the vehicle can be brought to a sudden stop without arresting the rotation of the driving wheels, so that the strain upon the motor, incident to the sudden application of the ordinary brakes is obviated.

RUNNING-GEAR FOR WAGONS.—W J Ott, Merlin, Ore In the present patent the purpose of the invention is to provide novel details of construction for a freight hauling wagon, which are light strong and durable, enable a quick turning movement, largely prevent destructive wear, and that may be produced at a moderate cost

MOTOR - G Keller, New York N Y The object here is to provide a motor or explosion engine of the two-cycle type arranged to utilize the motive agent to the fullest advantage by giving continuous impulses in proper rotation to a plurality of pistons connected with the main shaft to insure a steady and uniform running of the engine and hence permit the use of the motor on automobiles and the like

ANTISKID ATTACHMENT FOR VEHICLE-WHEELS.—T T Chaloner, New York, N Y The inventor's object is to provide a device, several of which are adapted to be attached at intervals to a wheel of an automobile or the like, to protect the tire and at the same time prevent the wheel from skidding

VEHICLE-TRUCK OR RUNNING-GEAR.—W S Wills, Covington Va The improvement is in trucks and running gear, whereby the inventor reduces and distributes the jar or shock incident to contact of the wheels with obstacles in the road way, and whereby the vehicle bed or frame to which the truck proper is attached will not be lifted as much as that one of the wheels which may pass over an obstruction Thus in a vehicle provided with this attachment, springs may be dispensed with

JOINT-COVER. A G Williams, Sidney N Y This cover for protecting a ball joint, comprises a flexible sleeve adapted to be opened out in the form of a flat sheet and provided with an opening on its side, with the walls of the opening formed of an elastic material and adapted to be expanded over the ball of the joint and closely fit around the member to which the ball is secured

VELOCIPEDE.—M Slotkin, New York, N Y Through the medium of the clutch a continuous movement can be imparted to the driving axle and when two clutches and accompanying parts are employed the forward motion of the vehicle will be positively uninterrupted, and when a single clutch is used the momentum of the vehicle after one movement of the pedal or lever will carry it forward until the clutch is again brought into active operation

LOADING MACHINE. G Kruse George, Iowa This machine is especially adapted for loading manure into a wagon An object of the invention is to provide a device capable of lifting large loads and of depositing them in a waiting vehicle without the use of engines or other power generators, the action of the machine depending entirely upon the power supplied by hand

CARRIAGE-LAMP BOX.—R E. Cole, Democracy, Ohio. The object of the invention is to provide a box or case, to be secured beneath the bottom of a buggy, to carry an ordinary stable lantern so that the lantern may act as a carriage lamp while driving, and as a lantern when out of the buggy or carriage and to serve also as a heater for the buggy or carriage

Designs.

DESIGN FOR A FABRIC FOR WINDOW SHADES OR SIMILAR ARTICLES.—A A Boeck, New York, N Y The design presented in this case is an original arrangement of vertical and cross lines which show an ornamental effect heightened by alternating the density of the rows of patterns. Mr Boeck has designed another arrangement of cross and vertical lines embodying some of the effects of the denser band in the former design.

DESIGN FOR FABRIC —D Valentine, East Orange, N J In this fabric design the brilliant effect is produced by a broad mass of solid round discs one-quarter of an inch in diameter on a white background. The discs do not quite touch and are in perfect alignment, with a white line running through the centers of the discs up and down and across.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 18th or will be sent by mail on request.

(12174) H T VanP asks 1. How longitude or sidereal time is determined by the moons of Jupiter? A Longitude is determined from the eclipses of the moons of Jupiter, by having a table of these eclipses in Greenwich time. This is published every year in the Astronomical Ephemeris by the United States Naval Observatory, Nautical Almanac Division. The moment of the occurrence of an eclipse is observed in local time The difference between the local time of occurrence and the Greenwich time of the same eclipse is the difference of longitude required 2. Is there a formula for getting the equation of time without using tables? A The equation of time is the difference between the time of the true sun and that of the mean sun. Tables are given for it in works on astronomy One may be found in Todd's "New Astronomy" which we send for $1.50 This gives the equation of time for each five days in the year 3 Having the tables of the equation of time for one year say 1909, can the equation of time be determined for the next year or any year following? A The equation of time is the same for each year A table for one year is the same as for any other

(12175) W P says Would you please inform me what are dry cells composed of? What is the chemical used in them and how can I recharge them when their powers get diminished or worn out? A There is little to be gained in recharging dry cells, if time or money are considered The cement may be broken out at the top and a strong solution of salt ammoniac may be put in and allowed to soak down through the cell This will take considerable time Others have punched holes in the side of the outer jaw and set this in a glass battery jar which is filled with the sal-ammoniac solution You will find in our Supplements 1383 and 1387 price ten cents each, valuable articles upon the making of dry cells. It would be better to make new cells than to repair old ones.

(12176) M R. says We are told that the earth spins around making one revolution every 24 hours which is really very fast for so large a ball Does the envelope of air which surrounds the earth turn with the earth as though it were a part of the earth, the winds which we experience being minor disturbances in the lowest stratas of the atmosphere? If this envelope does turn with the earth as though the two were one, can you tell me why it does so? If it does not, why do we experience at times perfect calm on some of the highest points of the earth's surface? I would like to get a convincing answer either one way or the other A. The air is a part of the earth and a very heavy part of the earth The weight of air above each square inch of the surface of the earth is 15 pounds, with some variations from time to time This gives for the weight of the whole atmosphere 5,000,000,000,000 000 tons. The air moves with the earth as it rotates. If it did not we should have an east wind at the equator all the time blowing 1 000 miles an hour This would tear everything off the earth and leave it a barren mass of stone The winds which we have are due to the heat of the sun. Davies' "Elementary Meteorology," which we send for $2.50, will give you much information on such topics.

(12177) T O W says Will you kindly tell me if metal reinforcements have ever been successfully inserted and used in such materials as sewer tile where the clay was burned and glazed? Would it be possible to use iron in this way, or would the iron oxidize and also expand too greatly? A We have no information as to metal reinforcement having been used in baked clay tile, but have no doubt that it can or could be so used, since it is satisfactorily used in glass. The difference between the expansion of iron and that of pottery is too small to set any internal stress when the former is imbedded in the material of lower heat conductivity and the metal sufficiently protected from oxidation as in concrete.

(12178) W V L. says Will you recommend a paper on the subject of babbitting journal boxes for machinery? I am especially anxious to learn best method of pouring babbitt around a shaft, leaving a solid box and yet leaving the shafting loose enough to turn free and easy You know it always shrinks tight on the shaft if the journal has not been treated in some way to prevent as the babbitt cools. I get along very well with split boxes, yet there is much about this I would like to know a good article on. Is there any process by which babbitt may be made to solder or weld to the inside of the cast iron box? Can they be tinned by the use of acid and the soldering iron as copper, so that the hot babbitt will adhere while it is being poured? If you have numbers of the Supplement covering this, the

portant subject of Babbitting Bases in general, will you please point them out to me? A. We regret that we have no SUPPLEMENT numbers exactly covering the point you mention. A babbitt composed of 1 part of antimony to 4 parts of lead has excellent anti-friction properties, is hard, and shrinks almost not at all on cooling. The writer has had good success in casting solid bushings or boxes around small shafts with the above, and even with bronze, by coating the shaft thickly with lampblack (from a miner's hand lamp burning lard or similar oil), and then pouring the metal around it. The lampblack being pure carbon, makes as good a lubricant as graphite when mixed with oil.

(12179) F H says Will you please settle a dispute that has arisen on the following subject: A claims that it grows colder the deeper we go into the earth basing his argument on the fact that cold water oftenest comes from deep wells and that a certain iron mine is very cold at its greater depths, so much so that visitors are given overcoats to wear before taken down B claims that A s argument is entirely fallacious and based on special conditions that the fact is that the temperature increases as we go down into the earth, approximately at the rate of one degree for every fifty feet. A It is a well known fact that the temperature rises one degree for every 50 to 60 feet which we go down in the earth below the level of unchanged or constant annual temperature That there are cold springs is of course true There are also hot springs, boiling hot springs, in many places on the earth And the general statement which we made above is certainly true The subject is treated in all textbooks of geology We can sent you Scott s, one of the most recent and best, for $2.80 postpaid.

(12180) L. F says Please tell me what constitutes a horse-power for the steam engine, and from what did the name horse-power originate? What is vacuum? A The term horse-power means as the name implies, the power of a horse, and was established by James Watt, in order that he might have some basis of comparison of the power developed by his engines. He measured the work done by a heavy London draft horse of the Clydesdale or similar variety during short intervals by observing the weight it could lift against gravity, the horse of course walking on the ground and pulling horizontally on a rope led through pulleys, so that the weight rose vertically The unit horse-power, so established, was 550 foot-pounds of work per second or 33,000 foot pounds per minute i e, 33,000 pounds raised one foot in a minute, 330 pounds raised 100 feet, or 1 pound raised 33 000 feet per minute, but whereas few horses could do that amount of work for more than a few seconds together a 1 horse-power engine will go on producing that amount of work indefinitely so long as it is supplied with steam

(12181) W. K. B. says I am interested in knowing what kind of satisfaction dry colors ground with crude oil would give used as a cheap paint for such buildings as barns, etc. My idea is to let the crude oil take the part of linseed oil, the use of which would greatly reduce the price of this class of paint I am told by a painter that he used to work in the oil districts at his trade and that he had used a great deal of this kind of paint. A The experience of your friend who has tried it may be a better guide than our theory, but we should not say that the mixture of pigment with crude petroleum would form a satisfactory paint from any point of view except that of first cost Crude oil is not colorless or transparent and would discolor the more delicate pigments, making yellow, for instance, a rather dirty green Then again, linseed oil has the property of increasing in weight upon oxidation by exposure to atmosphere, thereby adding to its protective value, whereas the only constituents of petroleum preservative to metals from corrosion are volatile, and upon evaporation of its oils the paint made from it would have no value unless the pigment itself were preservative and capable of hardening into a continuous coat.

(12182) C A. R. B. says 1. Please inform me what weight a thousand cubic feet of hydrogen will sustain A One thousand cubic feet of hydrogen will sustain 70 pounds at normal barometer at sea level and the freezing point, 32 deg Fahr 2 The weight of a cubic foot of air at sea level and at 5,000 feet altitude, if you have the information at hand. A. A cubic foot of air at normal barometer and 32 deg Fahr weighs 0.08071 pounds. At an altitude of 5,000 feet under the same conditions the air will be about five-sixths as heavy, that is, when the barometer is normal at the sea level, at 5,000 feet above the sea the barometer will stand about 25 inches, or five-sixths as high.

(12183) J. M K. says As a reader of your valuable paper I would like to ask the following queries: 1. Is a mercury incubator thermometer liable to break or crack on being exposed to a sudden change of temperature from 104 deg. F. to 32 deg. F.? A. A mercury thermometer should not break by a sudden change from 104 deg. to 32 deg. Still it is not necessary to plunge such a thermometer into ice to test it. Make the change gradually and give time for the glass to take the new temperature. 2. How can I change a telephone generator into a dynamo? A. [illegible] generator is run by [illegible] generator It is provided with permanent magnets and does not require a field winding.

NEW BOOKS, ETC.

THE ART OF THE BELGIAN GALLERIES. By Esther Singleton. Boston L. C Page & Co., 1909 12mo., 369 pp 48 plates. Price, $2.

The author has produced a most readable book, which will be valuable to the visitor to the galleries of Antwerp, Brussels, and Bruges. The book is intended for a help to the student in tracing the course of Flemish art by the notable pictures to be found in the Belgian galleries. The introductory part contains short biographies of the chief masters whose works are contained in the galleries, and descriptive matter relative to their places in the course of Flemish art together with some description of their individual art and their influence on others. In describing the art of the individual galleries, the general plan has been to deal first with the masterpieces of the collection and the works of the greatest masters grouping the latter irrespective of subject The illustrations are admirably selected and are beautifully reproduced in warm sepia tones. In comparing this volume with the preceding one on "The Art of the Netherland Galleries," the effect of religion on the development of the schools is very marked, for while the Protestant Dutch were painting portraits or scenes of domestic life as well as landscapes, the Roman Catholic Flemings were still painting large pictures of religious subjects in the old spirit of devotion Now that the whole world is turning with more and more interest to old Dutch and Flemish pictures, this volume *will prove of great interest*

CHATS ON OLD SILVER. By E L. Lowes New York Frederick A Stokes Company, 1909 12mo , 320 pp Price, $2

This sumptuous book is freely illustrated by 54 *full-page illustrations and numerous line* drawings in the text There is also a colored frontispiece The subject is a most fascinating one, for among all the objects of fine art which the amateur collects, there is nothing which is so easy to acquire and so satisfactory as old silver Fine furniture, choice prints, and goodly pictures are objects greatly sought after but they must be fine and bear the outward and visible sign of some master hand to be worth collecting They have also to bear the constant risk of deterioration, to withstand the continued fluctuations of taste, and consequent rise and fall of the market whereas old silver on the contrary has sound foundations there is no doubt about its date and market value It is writ so large that he who runs may read The making of a collection of old silver is literally within the means of the middle-class collector The author knows his subject well and treats the same with a breadth which is truly refreshing in a book for collectors by a collector The text *is printed on beautiful light tinted paper most* agreeable to the touch and to the eye, while the inserted plates are printed on the whitest of coated paper The section relating to hall marks and date letters is most valuable The sale prices which are appended give valuable indications of the market during the last few years.

THE SLIDE RULE. An Elementary Treatise. By J J Clark, M E Scranton, Pa. Technical Supply Company 18mo., 62 pp 1 plate

The author has been approached many times by engineers owning a slide rule, but who are practically unable to use it, with a request as to how to use it in certain cases. This has served to demonstrate that the instructions studied were not understood, and that they were so difficult, meagre, or ambiguous that the reader did not have patience to study them until he had mastered the intricacies of the rule. This is very true; for of the slide rules *in existence many are not put to anything like* their full use, owing to the fact that the principles have not been thoroughly mastered To the person who thoroughly understands three or four of the leading principles the slide rule is a wonderfully simple and easily operated instrument *It is not necessary for* him to remember any settings, and he can solve any case with ease and precision Bearing this in mind, the author has endeavored to explain these principles so thoroughly that they cannot be forgotten, and in such a manner that anyone with a fair knowledge of arithmetic can readily understand them The writer of this review may state that his slide rule has been given added value after a perusal of this little work.

DOCKHAM'S AMERICAN REPORT AND DIRECTORY OF THE TEXTILE MANUFACTURE AND DRY GOODS TRADE. Boston Dockham Publishing Company, 1909 Quarto, 642 pp Price, $6

This is the twenty-second edition of the forty third year of this most valuable publication There is no subject more difficult to deal with than the question of textile manufacture and this is the only book which will solve many of the difficulties. It has many excellent points, such as statistics on the looms in the United States, the number of cotton spindles, sets of wool cards, worsted combs, etc There is also a list of textile manufacturers arranged alphabetically by States, including Canada and Mexico also. There are separate lists for bleacheries, cotton dealers, cotton goods manufacturers, wholesale dry goods, dryers, finishers, and mercerizers, exporters, importers, print works, wool dealers, wool-hat manufacturers, and yarn dealers.

WIRELESS TELEGRAPHY AND HIGH FREQUENCY ELECTRICITY By H La V Twining, A.B. Los Angeles, Cal. Published by the author 8vo , 202 pp Price $1 50

The many amateur wireless-telegraph operators in this country use induction coils rather than *transformers because the induction coil* is convenient and because very little has been written on the subject of small transformers adapted for their particular uses The author of the present work goes into the subject of building transformers to take the place of induction coils and supplies the data necessary for building fourteen sizes of transformers of from one hundred watts to five kilowatts. While the theory of wireless telegraphy and high frequency apparatus is explained, this is done in a very simple manner so that it can readily be understood by those who have not had a course in electrical engineering. The construction described are eminently practical, and the result of the author's own experimental work

CHATS ON OLD EARTHENWARE By Arthur Hayden. New York Frederick A. Stokes Company, 1909 12mo , pp 496 Price, $2.

This beautiful book is accompanied by 150 illustrations and tables of over 200 illustrated marks. Five years ago the author published Chats on English Silver which was warmly received A great number of readers wrote to the author suggesting that he should write a companion volume dealing with old English earthenware The collection of old English earthenware, in the main is still within the reach of those who have slender purses, while English china within the last decade has reached prohibitive prices After a bibliographical sketch comes a glossary then a chapter on How to Collect for Beginners which is extremely valuable This is followed by chapters on Early Ware English Delft Stoneware Early Staffordshire Ware Slate Glazed Ware, Josiah Wedgwood Leeds and other factories, Transfer Printed Ware Staffordshire Figures Swansea and other factories Lustre Ware and Late Staffordshire Ware There are valuable lists of prices appended to every chapter The book is very handsomely made and is sure to merit the attention of all collectors

POTTERY OF THE NEAR EAST By Garrett Chatfield Pier New York G P Putnam's Sons, 1909 12mo , pp 175, 64 illustrations Price, $5 50 net

Many choice and remarkably preserved examples of the ceramic wares of this section of the Orient have recently reached our markets examples distinctive in material form and ornamentation Among these were found certain pieces of more than usual interest, since they provide us with new facts in regard to the dating of certain of these early mediæval ceramic productions To present these facts as concisely as possible is the purpose of this monograph which it may be added deals with the Muhammedan wares of every section of the Near East with the single exception of those of Saracenic Spain so ably treated of by Dr Van de Put.

CATALOGUE OF THE WORKS OF ART BELONGING TO THE CITY OF NEW YORK New York Prepared and issued by the Art Commission of the City of New York, 1909. Large 8vo , pp 241

The City of New York began its valuable collection of portraits in 1790 by requesting Gen Washington to permit Mr. Trumbull to take his portrait to be placed in the City Hall as a monument of the respect which the inhabitants of this city had toward him Since this time the city has been acquiring works of art of all kinds. Technically these works of art are under the charge of and they are passed upon by the Art Commission of the city of New York The constitution of this commission is most admirable Its present members are Robert W De Forest Frank D Millet John B Pine George B McClellan A Augustus Healy John Bigelow Arnold W Brunner, Charles Howland Russell Fred B Pratt and Herbert Adams Thus we have artists, sculptors officers of literary and artistic societies and museums, as well as a painter and a sculptor If it were not for this estimable body the city of New York would have foisted upon it most atrocious works This commission is an artistic safeguard of the city The book is a beautiful one, magnificently printed and it gives a complete *catalogue raisonné* of all the works in the possession of the city numbering several hundred. The plates are superbly executed

THE STORY OF DUTCH PAINTING By Charles H. Caffin. New York The Century Company, 1909 Square 8vo , pp 200 Price, $1 20 net

The tale of how the Dutchmen of the seventeenth century developed a new school of painting is a part of the story of the lives and fortunes of the Dutch people and to know something of the latter helps to appreciation of what these Dutch painters tried to do, and how they succeeded. Mr Caffin tells what the principal Dutch artists accomplished in portraiture in landscape and in the representation of the indoor and outdoor life of the people why they chose these subjects, and why they treated them as they did The result is a complete and readable handbook of Dutch art equally appealing to wide-awake young people and to adult students of art The reproductions of notable Dutch paintings add to the volume s value and interest

IN WILDEST AFRICA By Peter MacQueen, F R G S Boston L C Page & Co 1909 12mo , pp 402 Price, $3

This is a description of a hunting and exploring trip through Uganda Victoria Nyanza the Kilimanjaro region and British East Africa, with an account of an ascent of the snow fields of Mt Kibo in East Central Africa and a description of the various native tribes. The book is admirably illustrated by a very valuable series of 64 plates from the original photographs taken chiefly by the author s traveling companion Peter Dutkewich It is also accompanied by a map showing the district under discussion The publication of this book is timely owing to the appearance of the interesting articles by ex President Roosevelt covering the same ground The contribution of Mr Dutkewich who is a Russian by birth but who has lived most of his life in America is most unique He is a professional outdoor photographer and has made 12 000 negatives in all parts of the country The author s text is clear and interesting and is an admirable exposition of life in this wildest part of the globe Equatorial Africa is one of the most fascinating countries in the world It allures and repels It is beautiful as an opium dream, baneful as nightshade One day a man is well and strong the next he is dead and buried But just as the Americans improved the conditions in Cuba and Panama so will the English, French and Germans probe into the sombre mysteries of Africa dispel the clouds with which it has been draped for five millen*niums, and make it in a few decades, a land* of light learning and liberty Few seem to realize that Africa is no longer the Dark Continent

THE ELEMENTS OF MACHINE DESIGN Part I General Principles, Strength of Materials, Rivets, Bolts and other Fastenings, Journals and Shafting, Couplings, Pedestals, Transmission of Power by Gearing, Belting, Ropes, and Chains By W Cawthorne Unwin LL.D, F R S New edition, revised and enlarged London Longmans Green & Co , 1909 8vo , pp 531 Price, $2 50

This treatise is intended to occupy a distinct field between works on applied mechanics and empirical books of rules and examples of machine details. In common with the former the scientific rules applicable to, and the design of machines are given with such an amount of clearness and explanation as is necessary to *make them intelligible to readers acquainted* with the general purpose of mechanics It has been aptly said that the engineer is a man who is continually being called upon to make up his mind but whatever it is after it is once decided it is irrevocable for it is transmitted into steel, iron and copper and cannot readily be revoked It therefore behooves the engineer to be posted at every possible point The book is a very valuable one and the fact that the practice is English does not seriously militate against it

SPRING FLOWERS AT BELVOIR CASTLE. By W H Divers London Longmans Green & Co 1909 8vo , pp 194 Price, $1 80 net

Belvoir Castle is one of the finest country seats in England The author is head gardener to his Grace the Duke of Rutland Owing to the large number of inquiries which he has received concerning the cultivation of the spring bedding plants in this garden he has been in*duced to write this beautiful little book* which is a charming exposition of what landscape gardening really means The author hopes that many others will be led to cultivate these interesting and beautiful plants more extensively and thus make their gardens more beautiful in the early months of the year These hardy plants appeal to a large number of persons not only because of their beauty when seen in a mass, but because of their low cost and the small amount of labor required to take care of them during the summer months and for transplanting them in the autumn Thus they are adapted for everyone who has a garden The illustrations are from photographs taken by the author They show that he is not only an expert gardener but a photographer of no *mean order*

PRACTICAL HOUSE FRAMING By Albert Fair New York Industrial Book Company, 1909 108 pp , 98 illustrations, 12mo Price 50 cents

The series of articles on house framing was recently published in The Practical Carpenter Mr Fair the author of these articles has prepared them in the form of a practical text book for beginners and a reliable guide for journeymen It takes up the subject of braced *frame construction*, containing many useful hints and suggestions on these forms of house framing.

HOW TO MAKE TABLETS By Frank Edel Boston The Spatula Publishing Company 24 page pamphlet Price, 25 cents

Among the products of modern pharmacy none are more popular than compressed tablets, and it is a very easy matter for the ordinary druggist with a small expenditure to make tablets which are better than those of the larger manufacturers.

QUESTIONS AND ANSWERS ON THE PRACTICE AND THEORY OF SANITARY PLUMBING. Vol I Drainage and Venting. Ninth Edition, revised and enlarged, by R M Starbuck. Hartford, Conn: The Bond Press Company, 1909 16mo, pp 154 Price, $1

This little volume has passed through a number of editions, each one of which has been presented to the reader in a more valuable form than the preceding one. The original purpose was to present the subject in as concise, brief and practical manner as possible. The popular question-and-answer system is employed.

HINTS FOR CARPENTERS. Compiled and edited by Albert Fair. New York: Industrial Book Company, 1909 12mo., 144 pp., 101 illustrations Price, 50 cents

This is a collection of practical hints for amateur carpenters and joiners and explains how to take care of their tools and make various appliances which will lighten their work. The material has been taken from The Practical Carpenter and is a collection of ideas of practical men. Some of the devices may appear very simple and elementary but the author does not hesitate to include them in the collection because of the possibility that they might in certain cases prove to be of the utmost value to the reader.

DYNAMOS AND MOTORS. A Text Book for Colleges and Technical Schools. By William Suddards Franklin, Professor of Physics, Lehigh University and William Esty, Professor of Electrical Engineering, Lehigh University. New York: The Macmillan Company, 1909 8vo., 489 pp Price, $4

This is a physical treatise on dynamo electric machinery, taking up the subject in five parts. The first deals with electric current, the dynamo and the transformer and the measurement of direct current and alternating current. Part II deals with direct-current generators and motors. The theory of alternating currents is taken up in Part III, while alternating-current generators and motors form the fourth section of the book. The fifth part is devoted to the practical operation of dynamos and an explanation of switchboards and switchboard appliances. The book is primarily a text book adapted for the requirements of the student, and aims to give him a good basis of theory as well as a practical conception of the direct and alternating current dynamos and motors.

THEORY OF STRUCTURES. By R. J Woods, M E, M Inst C E. London: Edward Arnold. 1909 8vo, pp 276, 157 illustrations Price, $3

This new volume although self-contained and independent of "The Strength and Elasticity of Structural Members" by the same author forms a continuation of the previous work suitable for very advanced students and draftsmen engaged in structural design. The elemental parts and formulæ of the former volumes are extended and utilized for a determination of the design of masonry and steel structures. Experience in the practical design of structures and a deepening sense of its importance has convinced the author of the great merit of presenting examples for study in a clear and intelligible form. Consequently a large part of this book has been given to the working out of practical examples. It is a very useful book for any engineer.

ONE THOUSAND WAYS AND SCHEMES TO ATTRACT TRADE. By Irving P Fox and B. A Forbes. Boston: The Spatula Publishing Company. Small quarto 203 pp Price, $1

This little book is filled with some of the best schemes for attracting retail trade which we have ever seen and it is well worth the price charged for it.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 18, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid, manufacturing lactic, W Klapproth 947,079
Aerial cableways wheel for cars for, H S. Robinson 947 085
Air brake indicator, O R. Snyder 947 212
Air brake means fluid pressure, G T Rowton 947 098
Air compressor hydraulic J W Neal 946,685
Air current governor automatic S. P Smith 947 168
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Alarm. See Burglar alarm
Alarm and signaling system G M Willis 947,208
Alloys treating nickel-copper J F Thompson 947 087
Amusement apparatus A W Jones 946,780
Annunciator D A Backer 946,682
Apparel means for supporting wearing H. P Cole 946,656
Automobile driving shafts, shock absorber for, C A Benoist 946,868
Automobile fender, J R. Hickey 946 777
Automobile safety device R. B. Love 947 112
Automobiles, hydrocarbon burner for J N Leach 946,605
Auxiliary spring O. L. Thomas 947 167
Awning attachment, C P Fester 946,827
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HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & Co., Inc. 361 Broadway, New York City or by any bookseller or newsdealer

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Concrete Reinforced Concrete —AND— Concrete Building Blocks

Scientific American Supplement 1543 contains an article on Concrete, by Brysson Cunningham. The article clearly describes the proper composition and mixture of concrete and gives results of elaborate tests.

Scientific American Supplement 1538 gives the proportion of gravel and sand to be used in concrete.

Scientific American Supplements 1567, 1568, 1569, 1570, and 1571 contain an elaborate discussion by Lieut. Henry J Jones of the various systems of reinforcing concrete concrete construction, and their applications. These articles constitute a splendid text book on the subject of reinforced concrete. Nothing better has been published.

Scientific American Supplement 997 contains an article by Spencer Newberry in which practical notes on the proper preparation of concrete are given.

Scientific American Supplements 1568 and 1569 present a helpful account of the making of concrete blocks by Spencer Newberry

Scientific American Supplement 1534 gives a critical review of the engineering value of reinforced concrete.

Scientific American Supplements 1547 and 1548 give a resume in which the various systems of reinforced concrete construction are discussed and illustrated.

Scientific American Supplement 1564 contains an article by Lewis A. Hicks, in which the merits and defects of reinforced concrete are analyzed.

Scientific American Supplement 1551 contains the principles of reinforced concrete with some practical illustrations by Walter Loring Webb.

Scientific American Supplement 1573 contains an article by Louis H Gibson on the principles of success in concrete block manufacture, illustrated.

Scientific American Supplement 1574 discusses steel for reinforced concrete

Scientific American Supplements 1575, 1576, and 1577 contain a paper by Philip L. Wormley Jr on cement mortar and concrete, their preparation and use for farm purposes. The paper exhaustively discusses the making of mortar and concrete, depositing of concrete facing concrete wood forms, concrete sidewalks, details of construction of reinforced concrete posts.

Each number of the Supplement costs 10 cents.

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The Scientific American Boy

By A. RUSSELL BOND

has just been reported as one of the books at present most in demand at

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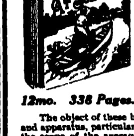
THIS is a story of outdoor boy life, suggesting a large number of diversions which, aside from affording entertainment, will stimulate in boys the creative spirit. In each instance complete practical instructions are given for building the various articles. The needs of the boy camper are supplied by the directions for making tramping outfits, sleeping bags and tents, also such other shelters as tree houses, straw huts, log cabins and caves. The winter diversions include instructions for making six kinds of skate sails and eight kinds of snowshoes and skis, besides ice boats, scooters, sledges, toboggans and a peculiar Swedish contrivance called a "rennwolf." Among the more instructive subjects covered are surveying, wigwagging, heliographing and bridge-building, in which six different kinds of bridges, including a simple cantilever bridge, are described.

12mo. 320 Pages. 340 Illustrations. Price $2.00 postpaid

THERE HAS RECENTLY BEEN ISSUED A SEQUEL TO THIS BOOK ENTITLED

The Scientific American Boy at School

By A. RUSSELL BOND



IT takes up the story of "Bill" and several of his companions at boarding school. They form a mysterious Egyptian Society, whose object is to emulate the resourcefulness of the ancients. Their Chief Astrologer and Priest of the Sacred Scarabæus is gifted with unusual powers, but his magic is explained so that others can copy it. Under the directions of the Chief Engineer, dams, bridges, and canal-locks are constructed. The Chief Admiral and Naval Constructor builds many types of boats, some of which are entirely new. The Chief Craftsman and the Chief Artist also have their parts in the work done by the Society, over which Pharaoh and his Grand Vizier have charge. Following is a list of the chapters:

Initiation; Building a Dam; The Skiff; The Lake House; A Midnight Surprise; The Modern Order of Ancient Engineers; A "Pedal Paddle-Boat"; Surveying; Sounding the Lake, Sig. nalling Systems; The Howe Truss Bridge; The Heliograph; The Canal Lock; Hunting with a Camera; The Gliding Machine; Camping Ideas; The Haunted House; Sun Dials and Clepsydras; The Fish-Tail Boat; Kite Photography; Water-Kites and Current Sailing; The Wooden Canoe; The Bicycle Sled; Magic; The Sailboat; Winter Sports; and A Geyser Fountain.

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The object of these books is to instruct boys how to build various devices and apparatus, particularly for outdoor use. The constructions are fully within the scope of the average boy and the instructions are interwoven in a story which makes the books interesting as well as instructive.

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Conveyor, package, M. O. Roberts 946,699

A NEW ERA OF THE AMERICAN LOCOMOTIVE.

(Concluded from page 100.)

Atlantic type and the six-coupled type which succeeded it in fast passenger service. Commencing at the tender, which is of huge size in itself, we note that it is carried on two six-wheel trucks, a novelty in tender construction. The tank capacity is 4,000 gallons of oil and 12,000 gallons of water. The boiler, 6 feet in diameter, has 202 square feet of heating surface in the fire box, 3,275 square feet in the fire tubes, and 1,279 square feet in the feed water heater tubes, making a total of 4,756 square feet. In the super-heating and re-heating section there are 1,121 square feet of tube surface.

The firebox is built up of steel plates, flanged to a channel section and riveted together with stay plates riveted in between the opposite flanges of the outer and inner shell. The fire tubes, 21 feet long, terminate in a combustion chamber, 10 feet, 9 inches long, which contains the super-heater and the re-heater. The front combustion chamber, which forms the feed water heater, contains 417 tubes, 2¼ inches in diameter by 6 feet 8 inches long.

The boiler with its super-heater and feed water heater extension is connected rigidly to the frame in which are carried the pair of trailing wheels, the six coupled drivers, and the high-pressure cylinders. The low-pressure cylinders, the forward truck and the four coupled drivers are carried in a separate frame and the weight of the forward portion of the boiler, feed water heater, etc., is carried upon this forward truck by means of two sliding bearings which allow the frame to move laterally underneath the boiler, as the locomotive enters upon a curve. This necessitates employing a flexible steam pipe for conveying the steam from the re-heater to the low pressure cylinders and the necessary flexibility is secured by using both slip and ball-and-socket joints in the steam pipe. Piston valves are used with both high and low-pressure cylinders, and the valve motions are of the Walschaert type. There are two high-pressure cylinders 24 inch diameter by 28 inch stroke, and two low-pressure cylinders 38 inch diameter by 28-inch stroke. The driving wheels are all 73-inch diameter.

The general construction of the freight locomotive is similar to the passenger locomotive, but the dimensions, weights and power are, of course, much greater. The boiler is 7 feet in diameter, works under a pressure of 220 pounds, and has a total heating surface, including the feed water heater, of 6,631 square feet. There are also 1,745 square feet of super-heating and re-heating surface. There are two high-pressure cylinders, 26 inches in diameter by 34 inch stroke, connected to eight-coupled drivers 63 inches in diameter, and two low-pressure cylinders 38 inches in diameter by 34 inch stroke connected to eight-coupled 63 inch drivers. The tender contains 4,000 gallons of oil and 12,000 gallons of water. The engine alone weighs 231¼ tons, and the engine and tender together weigh 350 tons. The total pull on the draw bar maximum power is 54 tons.

It is no exaggeration to say that these locomotives mark a new era in American locomotive practice, for although the Mallet system, super-heating, feed water heating and compounding have been tried out separately on various locomotives, this is the first time that these refinements have been embodied so completely on a single type.

HOW AN AMATEUR CAN FIND HALLEY'S COMET

(Continued from page 102.)

it. It appeared like any one of the many faint stars in the field of view. I should think it was about the eleventh magnitude on November 30th. The ephemeris makes it a little fainter, but as stated in the SCIENTIFIC AMERICAN

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Hay rake, R. C. Smith 946,981
Head covering, N. A. M. Hanis 946,770
Heating, cooling and ventilating system, J. C. Veil 946,869
Heating plant, G. C. Andrews 946,911
Hinge, A. N. Thomas 946,587
Hinge, adjustable, C. B. Trimmer 947,169

(Continued from page 113)

lately, it has been growing brighter quite rapidly of late

In looking for a comet one must not be too credulous, and think that the first object he sees is a comet Many times I thought I had found the comet and could see even the tail, but it proved to be merely a star elongated by the shaking of the telescope

Now the same manner of proceeding may be applied when the comet is near any other star, though it will not soon be so desirably located as on the evening of November 30th After the comet is bright enough so one can see its tail and head, one would not need to go to so great trouble but could systematically search a limited and definite area near it, and in a short time would be able to pick it up But it is not expected that it will be a very conspicuous object in a small telescope before the close of winter or early spring In the meantime the ambitious amateur astronomer can satisfy his interest by studying it in this manner

As an aid to those who may wish to try this plan, it may be observed that the evening of February 5th is favorable because of the comet's proximity to Epsilon Piscium Epsilon Piscium is in R. A. 0 hr 58 min, and Dec 7 deg 24 min From the ephemeris given for February 5th the following is its location on that evening R A 0 hr 57 min, and its Dec +8 deg and 11 min Similarly it will be found close to Delta and 62 Piscium on February 17th, and March 5th it will be just north of 51 Piscium Its motion is much slower during February than for the two preceding months, and so its location ought to be an easy task for the evenings immediately before and after these dates

Where the neighboring star is not as conspicuous, as in the case of Aldebaran one must study the constellation and familiarize himself with the stars in it until he can locate the desired star This is often somewhat tedious, as a few weeks ago, when I tried to locate it among the many small stars in Taurus directly above Orion It is, however, a helpful study for the amateur

I had a very gratifying and profitable study on the evening of January 14th, as may be seen by the cuts January 13th was the evening of nearest approach to Omicron Piscium, but as this was a cloudy night I decided to try the following night I had searched but a moment or two when it appeared in view I have seen it two or three times since November 30th, but it has never appeared so distinctly as on this evening It is still faint, though but a few seconds of arc in size, and could be easily passed over if the observer is not careful It looked more like a small nebula I could not state definitely but it appeared as though it had a faint nucleus. But the most gratifying result of the evening's study was the unmistakable motion detected as is clearly shown in the cuts Stars A and B were about twenty minutes of arc apart. The amount of motion could not be determined accurately with the 45-power, and the comet is still too dim to use the higher powers. I have had no further opportunity as yet to pursue this phase of the study but shall at the earliest possible moment It will suggest a problem for other amateurs I anticipate for many other amateurs as much delight in the scrutinizing of Halley's comet as I have already had

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It is estimated that the German Empire has nearly 35,000,000 acres of forest, of which 31 9 per cent belongs to the State German forestry on scientific lines has resulted in raising the average yield of wood per acre from 20 cubic feet in 1830 to 65 cubic feet in 1904 During the same period it has trebled the proportion of the sawn timber secured from the average cut. In fifty-four years it increased the money returns from an average acre of forest sevenfold, yet to-day the forests are in better condition than ever before

Hoe, garden, J H Shaw [illegible]
Hoisting device, Burke & Shinney [illegible]
Hopper, chemical mixing, C. A. Tabor [illegible]
Hose connector, L. R. Nelson [illegible]
Hose coupling, G R. Clay [illegible]
Hose rack, C. H Fish [illegible]
Hose reel, B. H Montgomery et al [illegible]
Hot water heater W H Bright [illegible]
Hub, metal wheel, G Manzes [illegible]
Humidifier, J Kelly [illegible]
Hydrant, H Lunceford [illegible]
Hydraulic elevator, N. P. Julien [illegible]
Hydrocarbon burner, C. M Kork [illegible]
Ice creeper, J Gregory [illegible]
Index, physician's card, C. P A. Hall [illegible]
Indicator, O. F Russell [illegible]
Induction meter, C D. Babcock [illegible]
Inkstand F H Allen [illegible]
Instrument holder, J Drexler [illegible]
Insulating chain for pull switches, H Hubbell 946,779
Insulating support G B. McBean 947,195
Insulating tube, M L. Coffey 946,665
Insulating wall, heat, C J Coleman 946,772
Insulation, heat, C J Coleman 946,773
Insulator E. Barton [illegible]
Insulator clamp, W G Clark 946,722
Insulator for electric lines, T Varney 946,625
Insulator for electric lines, section, H F Hoxie 946,846
Internal combustion engine, P D Johnston 946,159
Joint connection, ground, F B Swope, Jr 946,920
Kettle cover, H Ellis 947,088
Knife, H C Hart 947,103
Knitting machine, J C Duemler 946,684
Knockdown box, collapsible, C F Jenkins 947,179
Label holder G Peterson 947,036
Labeling machines, wiper attachment for bottle, E. Ermold 946,990
Lace winder G L. Williams 946,629
Lacing machine needle, shoe W A Smith 946,779
Lamp, N Krohn 947 041
Lamp socket cluster R. B Benjamin 946,922
Lamp socket, electric J G Peterson 947 123
Lamp, vapor burning L. L. Aydt 946,712
Lamps after a certain time, apparatus for automatic extinguishing of B. A Fagerlund 947 103
Lamps, apparatus for igniting miners safety E. A Hallwood 946,670
Lantern, W R. Hamm 947 036 to 947 038
Lasting machine E. A Stiggins 946,620
Lasting machine R Snow 946,708
Lathe, G A Steinle 946,920
Lathe turret, F S Thompson 946,824
Lawn sprinkler C A Twiggs 946,588
Leather and like material, method of and machine for treating edges of S Keats 946,844
Leather edging machine F F Cummins 947,054
Leather machine for inserting fasteners in, T G Plant 946,825
Leather splitting machine J Busfield 946,619
Lemon squeezer P Filler 946,668
Lenses and other spherical surfaces grinding bifocal Benison & Emerson 946,071
Letter sheet and envelop combined L. R. Swett 946 830
Level fluid, L J Deslattes 946,660
Life saving apparatus, J Frans 946,798
Lifter See Pan lifter
Lighting appliance F A Feldkamp 946,796
Lighting system W L. Bliss 946,715
Lighting system, carbureted vapor G E. Hulse 946,901
Lightning arrester W R Garton 946,542
Lightning arrester A Olsson 946,982
Lock, F D Tubbs 947,155
Lock and latch, H G Voight 947 069
Locomotive ash pan, R J Mitchell 946,553
Looms, smash preventer for W Louzo 947 003
Lubricating system splash, C N Teeter 946,923
Lubricator, J B & J G Purvis 946,580
Luggage carrier J H Tabler 946,850
Mail bag catching and delivery apparatus W G Miller 947 117
Mail bag crane Hannon & Matney 946,774
Mail receiving and delivering apparatus, W L. Wood 946,630
Manual training bench T L. Cooley 946 960
Manure spreader, T Brown 946,718
Marine table J H Jones 946,706
Massage apparatus C J Manning 946,972
Match case, pocket J J Manchester 947 004
Mattress spring fabric J J Brasnell 947 192
Meat hanger J Fowler 947 016
Mechanical movement, E Harris 946,671
Metal and the like apparatus for manufacturing leaf L. Kurz 946,676
Metal bars, bands tubes, wires fibers etc producing, O Schaller 947 162
Metal turning tool holder and tool G Goetz 946,599
Meters bill delivery mechanism for, B W Gallagher 946,961
Milk and cream can Clark & Campbell 946 654
Milk card holder E. F Meyer 946,998
Milking apparatus pneumatic, A. Gillies 947 156
Mill See Paper pulp mill.
Mine prop E. Schafer 946,879
Miner's tool combination A V Des Moineaux 947 020
Mixing machine A J Cropp 947 196
Moistener stamp and envelop, F W Granger 946 963
Molded article of granular material J S. Robeson 947 128
Molding machine G W Ross 946,780
Molding purposes, preparing granular material for, J S. Robeson 947 129
Mop, F E Hill 946,100
Mop wringer J Myers 946 765
Motor M R. Gattler 947,061
Motor control alternating current E. F W Alexanderson 946,751
Nursery chair and table F A Linger 946,942
Nut lock, F Bacon 946,713
Nut lock, Douglass & Willett 947 057
Nut lock F Weisel 947 059
Nut lock D H Miller 947 060
Oil burner, crude R A Bright 946,955
One-piece bag Schweitzer & Labadie 947,045
Optical testing instrument J F Forth 947 188
Ore feeder sampler, classifier and separator combined, H G King 946,750
Ore sampling apparatus, J A Van Mater 946,744
Ore treating apparatus, F E. Hatch 946,727
Outlet or junction box C T Pratt 946,646
Overhead line structure T Varney 946,624
Pan lifter W A Stang 400,586
Paper bag making machine, Hirsch & Elchberg 946,967
Paper cutter, W C Fuller 947 100
Paper feed roller A Schneelock 946,618
Paper hanging machine, R P Ekstrom 946,891
Paper holder shaving E. M Hols 946,736
Paper making machine screen, J W Reynolds 947 135
Paper pulp mill A F & O. R. Rahr 946,763
Paper retaining device, O W Downing reissue 13,077
Paper stand or support for rolls of, L. A Wheat 946,807
Peat fuel, apparatus for treating and utilizing Shepard & Wickham 946,788
Percolator, E. N Young 947,142
Percolator for coffee or tea pots, F Nather [illegible]
Peroxid of hydrogen making durable solutions of, J Arndts [illegible]
Photographic shutter, G L. Couroen [illegible]
Photographic shutter P J. Marks [illegible]
Piano violins, ring bow for G K Hennig [illegible]
Pickpocket detector, M. Wald [illegible]
Picture frame illuminating P Roberts [illegible]
Picture machine, moving F A Cole [illegible]
Pin setting and spotting device, G H Portsch [illegible]
Pin tumbler lock, C. H Thomas [illegible]
Pipe coupling clamping ring J Clark [illegible]
Pipe wrench, J R. Morris [illegible]
Planter gage, corn, L P Phillippi [illegible]
Planter, seed, C F Ward [illegible]
Planter shoe, N Klaus [illegible]
Plow, sulky, H Wiard [illegible]
Plows, row marker for, G. W Booth [illegible]
Plowshare A G Ferry [illegible]
Plumb lines to the roofs, sides, or floors of mine workings, tunnels, or for similar purposes, means for attaching, C. Nyquist [illegible]
Pneumatic apparatus, H. L. J. Gland [illegible]
Pneumatic display apparatus, F. E. Chapin [illegible]

Pole appliance, T H Briggs 946,593
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Portable table, C. H Mercer, ... 947,113
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Post mold E A Leonard . 946,908
Powder grains, machine for perforating and forming cellular H Maxim 946,943
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Printing mechanism W A Pringle 946,808
Printing plates press for stamping raised characters on H Pautze 946,824
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Printing press feed gage E L Megill 946 803
Pump, air, F S Carver 946 719
Pumping plant self regulating H Scheven 946 787
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Radiator mantel Bornmueller & Sachse 946 932
Radiator top Baerreau & Schmidt 946 691
Rail joint S. A Holman 946,545
Rail joint A Lawrence 947 108
Rail joint, Conway & Bisbing 947 174
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Railway attachment E E Barron 946 902
Railway frog Price & Shaw 946,,60
Railway joint J R Johnson 946,896
Railway paving plants, floor frame for G Merriman 946 907
Railway rail joint N H Williamson 946 930
Railway tie metallic, A M Baird 946 530
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Rake J Burger 946 658
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Razor, safety C G Ward 946,949
Razor safety J H Woods 947,010
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Refrigerating system E. Carpenter 946 771
Resistance terminal F D Hallock 946,776
Rheostat F W Harris 946,844
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Roller and scraper combination, W H McConnell 946,079
Rolling mill, J Fawell 946,793
Rolling mill J Fawell 946 794
Rolling mill J Fawell 946 795
Rolling mill R M Snyder 946 828
Rolling rails E E Slick 947 164
Roof covering metallic J W Reynolds 946,696
Roofing metallic, F B. Hale 946,906
Rotary explosive engine Williams & Gardner 947 008
Rotary press J A Dowd 947 018
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Sash holder and antirattler C S. Radford 946,785
Sash lock, D A Teeter 946 870
Sash lock J Rouniol 946,818
Saw drag W A Lawrey 947 182
Saw set R. A Parker 946 704
Saw tension device wire, J M Owens 946 807
Scale N Nilson 946 767
Scale automatic recording car G Goetz 946,600
Scale automatic weighing and recording car G Goetz 946,601
Scissors or shears G H Isbell 946,018
Screen, Lombeck & Theringer 946 071
Screens slider for bolting Johnston & Peck 946 848
Screening and sifting apparatus I E. Munger 946 782
Screw contact or vibrator W L. Pankoff 946 987
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Separators, eutidivider for the bowls of centrifugal liquid P L. Kimball 947 217
Setting up machine J H Dodds 947,174
Sewing machine E P Arnold 946 561
Sewing machine W A McCool 946 979
Sewing machine buttonhole Allen & Ringe 946 631
Sewing machine cabinet, Kundtz & Reber 946,876
Sewing machine, cabinet R R. Brown 946,983
Sewing machine feeding mechanism A H De Voe 946 662
Sewing machine looper operating mechanism B G Woodward 947 210
Sewing machine thread controlling mechanism, T. G Plant 946 783
Shade hanger window W D Lee 946 700
Shade roller support adjustable, H I & E L. Rich 947 084
Shaft liner, L N Brouillard 947 072
Shaper collar antifriction R Latcham 947 070
Sharpening device E. Moser 946 554
Shaving mug J C Dowd 946 937
Shingling hatchet gage L A Sayre 946 565
Shirt waist holder, T L McFadden 946,641
Shoe or sandal, steel J F McDonnell 946,846
Shotguns device for locking the breech blocks of repeating F Hardy 946 999
Shovels and the like power mechanism for grain M W Talen 946 621
Show case J M Waddell 946 626
Sifter control device A C Brantingham 946 716
Signaling means E J Burke 946,047
Siphon, Christopher & de Lukacsevics 946 535
Sleeve protector I J Fletcher 946,341
Small arms safety device for breech actions of J Tambour 947 066
Smoke stack J R Childers 946 056
Smoothing, polishing, filing etc machine for, T Nichols 947 023
Snap switch, electric N Marshall 946,690
Snow plow E K McLain 947 121
Soldering end seams of cans, means for W J Phelps 946 773
Spark arrester L. Miller 946 804
Spark plug J E Schaefer Jr 946 878
Sparking device Giles & Tobey 947 155
Speed meter W. I Sherwood 946 097
Sprayer, scalp T A De Vilbiss 946 538
Spring See Auxiliary spring
Spring trap N Liblom 946 606
Sprocket wheel Schandoney & Hall 946 582
Stalk cutter M E Clanton 946,720
Stamping machine feeding mechanism, J E. Smith 946,584
Steam and liquid pressure regulating device C P McMullen 946,613
Steam and other gases and vapors method of and apparatus for determining rate of flow of C C Thomas 946,898
Steam generator L. Wiehrowski 947 069
Steel scrap, utilizing J P W Beckman 947 081
Steel tie and rail joint, P A Haley 946,896
Stitch impression machine F P Dorsey 947 140
Stone polishing machine M Pembroke 946 616
Storage battery T A Edison 946,540
Store front construction, E. S. Rhoads 946,774
Storm front attachment, W H Lueif 946,761
Stove, B. Tancboff 947 205
Stove cap or lid, A H Peters 946,940
Stove, electric, Millspaugh & Vincent 946,643
Stove, safety methylated spirit Szakall & Kardos 946,690
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Structure, masonry, R Guastavino 947 177
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Structures and structure so reinforced reinforcing member for hollow, Hilborn & Roehl 947 178
Suction ventilator, G K & A A. Larson 946,941
Swing, H A. Myers 946 808
Swing, rotary, C. A Lewis 946 839
Switch. W D. Woodward 946,750
Switch interlocking mechanism, F C. Anderson 946,962
Switch operating mechanism, R. V Cheatham 947 082
Switch-throwing mechanism, J. B. Ritter 947 136
Syringe, bidet, M E. Reichelt 946,948
Table, N T Ackerly 946,951
Tag forming and affixing machines, cutting mechanism for D F Moore 947 202
Talking machine sound box, L. P Valiquet 946,590
Tank, C. E Rogers 947,130
Teaching. F. Van Voorhis 947,160
Teaching parliamentary law, means for, J T. Robert 946,[illegible]
Telegraphone, R. C Browne 947 142
Telephone mouthpiece, M Blass 946,[illegible]
Telephone mouthpiece, disinfectant, J W Dixon 946,[illegible]
Telephone transmitters, vibrator for, J P Edwards 946,[illegible]
Thermostatic compound, G. Dawson 946,[illegible]
Thermal cut-out or switch, safety, J W [illegible] 946,[illegible]
[illegible] E. R. Muller 946,[illegible]
[illegible] E. Pohl 947,[illegible]

Threads off tulle lace embroidery and the like, apparatus for cutting or shaving O L. Lerray 946 904
Threads, wires strips etc apparatus for testing F Zedlitz 946 741
Threshing machine beater Hines & Feller 947 157
Threshing machine frame F J Vrooland 947 117
Ticket holder C F Raschick 946 980
Tie jack C Berkner 947 071
Time controlled operating mechanism automatic J M Chappel 946 79_
Timepiece spring W V Bolton 946 663
Timepiece spring W von Bolton 947 146
Timepiece spring W von Bolton 947 147
Time recording register H B McCabe 946 808
Tire D W Jones 946 618
Tire armor C G Wright 947 141
Tire cushion, A F Hamburger 946 880
Tire inflation means for L N Brown 946 717
Tires reinforcement for pneumatic A I Murray 946,857
Tongs, bending S H Smith 946 567
Tongue for plows or cultivators J P Jones 947 158
Tonic applicator fountain C I Commons 946 837
Tool combination F H Koerner 947 002
Tool fluid pressure operated C H Johnson 947 181
Tool handle and tool handle fastening T H Draper 946 896
Tool holder for lathes planers and other working machines A H Rahm 946 947
Toy Gill & Aveling 946 699
Toy J Crane 947 085
Toy J Mason 947 043
Toy gun rapid firing W A Berlig 947 032
Toy mechanical I C Hopkins 946 778
Truck construction J W Leahy 946 700
Traction attachment for implements A H Wartchow 946 627
Tramway cable H H Peter 946,772
Transfer slip E. W Wauch 946,650
Transit mountain and mining F Heitzler 946 602
Trap See Backwater trap
Trolley hanger T Varney 946,025
Trolley line construction electric T Varney 946 590
Trolley system overhead K von Kando 946 749
Trolley wheel B F Smith 947 165
Truck brake W S. Adams 946 931
Truck for furnaces charging W F Jewell 947 180
Truck for harvesters, tongue J A Stone 946 905
Tube trimming machine J Nazel 946,682
Tungsten or other hexavalent high fusing point metals producing powdered W Majert 946 351
Turbine elastic fluid G Westinghouse 946 749
Turnbuckle or coupling W F Brock 946 494
Type bar forming machine F H Richards 947 005
Type bar making machine F H Richards 947 000
Type bars machine for making F H Richards 946 866
Type bars manufacture of F H Richards 946 867
Type casting and setting machine I Dropiowski 947 175
Type setting machine J B Odell 946 709
Typewriter paper feed attachment W R Dixon 946 724
Typewriting machine F B Hess 946 770
Typewriting machine H C Ford 946 707
Typewriting machine H L Wagner 946 814
Typewriting machine A T Brown 946 912
Ullage rod W I Dinsmoor 946 885
Urinal W J J Bowman 946 851
Urinal E. F Palmer 947 09_
Vacuum and flushing apparatus D Reidrick 947 190
Vacuum cleaner R B Hutchinson 946 901
Vacuum cleaning device J N Whitehouse 946 812
Valve J Rothchild 946 877
Valve automatic relief Hoeger & Penrose 947 197
Valve back pressure C C Neighbors 946 994
Valve dripping S I Erickson 946 077
Valve float C J Kirk 947 108
Valve flushing S W Lewis 947 183
Valve for engines pressure regulated gas C C Rioth 946 747
Valve for faucets automatic closing H M Williams 947 170
Valve for furnaces lift J R McKennan 947 201
Valve gas A S Lindkwist 947 04_
Valve hopper C W Hunt 946 547
Valve steam air and water trap F W Leatheser 946 070
Vapor converters protecting device for P H Thomas 946 812
Vaporizer heating device A F Osborn 946 806
Vaporizers cleaning device for hydrocarbon J Danischevski 947 058
Vaults, closure for grave J Pfeifer 946 862
Vegetable cutter Harbaugh & Smith 947 070
Vegetable masher and mixer C H & G A Malmquist 946 010
Vehicle bodies and seats spring support for P H Schwartz 946,991
Vehicle electric, F F Case 946 753
Vehicle shock absorber Muehlausen & Thomsen 946 _55
Vehicle top foldable A L. Dallain 946 658
Vehicle wheel R J Moore 946,614
Vending machines coin device for F W Smith 947 087
Ventilator See Car ventilator
Vessels depth regulating mechanism for moving G C Davison 946 850
Voltage regulator electric F R M Cutcheon 947 6_6
Voting machine key positioning device C F Currey 946 693
Wagon boxes metal cleat for O O Newberry 946 981
Wagon dump W Atkins 946 791
Wagon seat securing device C W Rasmus 947 028
Wall facing interior F Pedrick 946 731
Walls and the like bond tie for W H Brown 947 104
Warp beam G S Cox 946 541
Warp beam J Keeton 946 747
Washboard F N Maull 946 _2
Washboard F Hodgman 946 607
Washing machine C P Smith 947 116
Washing machine gearing Stocking & Mendenhall 946 790
Watch Mehl & Phelham 946 900
Water as motive power device for utilizing tide S M Smith 946 785
Water closet T J O Brien 946 951
Watering device for stock automatic H B McKinney 946 902
Watering device heater poultry C H Felker 946 607
Watering device poultry C H Felker 946 608
Weed hook adjustable spring A M Moe 947 119
Weevils machine for destroying cotton boll L M Trudhomme 946 561
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Wheels of vehicles means for securing spare rims to Hughes & Cave Moyle 946 074
Whiffletree F S Burlet 946 650
Winding machine S W Wardwell 946 811
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Window lock G McFarland 946,611
Window screen W S Marquis 946 577
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Wire stitching machine C G Clover 946 790
Wire stock die for bolt ball fluting C H Ballou 946 631
Wood splitting machine M J Power 946 70_
Woodworking machines spring post for C T Coombs 947 211
Yoke coupling J A Jackson 946 603
Zinc oxid apparatus for the production of W & H Simm 946 088

A printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863 will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co Inc 361 Broadway New York

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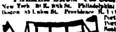

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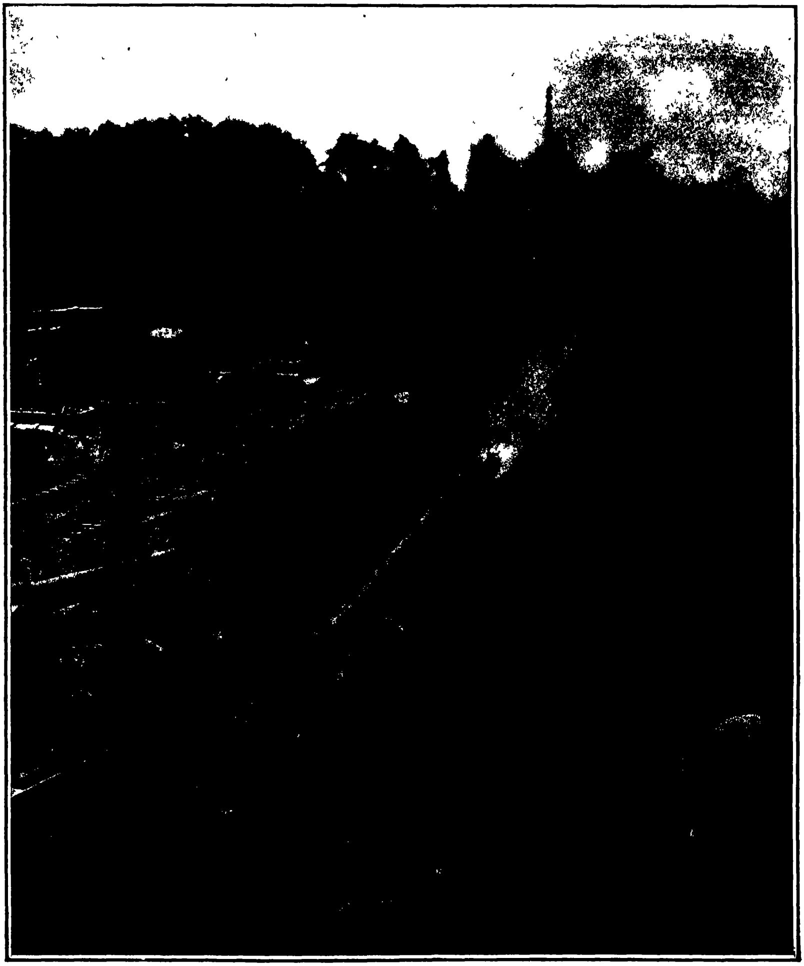

Discharge of an 8-inch navy rifle at Indian Head Naval Proving Ground.

WHAT SMOKELESS POWDER HAS MADE POSSIBLE.—I.—[See page 121.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic* the contributions will receive special attention Accepted articles will be paid for at regular space rates.

LESSONS OF THE PARIS FLOOD

IT is rather surprising that in all the voluminous descriptions of the Paris flood, which have been published in America, there has been given no complete analysis of the meteorological conditions which have turned the usually gentle and tractable River Seine into a raging torrent, and wrought unbelievable havoc in the far famed and beautiful city of Paris. It seems unlikely that any mere rainfall in the watershed of the Seine could have been sufficient to produce the present enormous flood, and it is probable that a great part, if not the major part of the flood water, is due to sudden melting of the snow in the mountains and on the higher levels.

Apart from the extreme suffering and personal inconvenience resulting from the flood, the most serious aspect of the calamity is the disastrous effects which must surely result from the inundation of the foundations of the city, and the flooding of its labyrinth of subways and sewers by a vast volume of water of great depth pressure and velocity It is a fact, well understood by engineers and architects, that foundation material which is perfectly stable in the dry condition, may lose much, if not all, of its supporting power when it becomes saturated, and particularly, if, as in the present case, the ground adjoining the foundation is full of such voids as are represented by subways, sewers, cellars and other excavations A substratum which will remain stable under normal conditions, may begin to flow or slide when it is saturated, in which case heavy cracks will appear in the superincumbent walls, if indeed the building be not thrown down altogether

Furthermore the cabled reports, referring to caving streets, bursting sewers and collapsing subways, indicate that another most destructive action of the water must be actively at work We refer to the subterranean flow of water under pressure along the face of foundations, subways, sewers and other subterranean masonry work Where such flow occurs, as for instance along the outside of a sewer, there is liable to be a washing away and displacement of the soil or other material, and where the sewers are filled with water under hydraulic pressure due to a considerable head, such as exists in the flooded district of Paris, it can easily be seen that, having but little strength to resist an outward thrust, they would be easily burst open, particularly if, as suggested, the enclosing soil had been washed away by the flow of water along their outer surface Only when the floods have subsided and a full examination can be made, will the full measure of the present disaster be ascertained, but the probabilities are that the rebuilding of sub-surface construction will have to be done on an enormous scale

Unquestionably, one result of the flood will be the undertaking of public works designed to prevent any repetition of the disaster An obvious plan would be to build a masonry retaining wall, or levee, throughout the whole length of the city and for some distance above it, carrying the work to a height sufficient to prevent any future overflow So enormous has been the volume of water that has come down, that unless the walls were carried to an inconvenient height, it would be necessary to increase the cross sectional area of the channel either by dredging which is practicable, or by widening, which because of the great value of the property that would have to be condemned for this purpose would seem to be out of the question.

There can be little doubt that the overflow at Paris has been greatly increased by the presence of so many masonry bridges, each of which embodies several heavy masonry piers that greatly reduce the area of the channel, and if the municipal engineers undertake a sufficient enlargement to absolutely prevent future overflows the question of the obstruction presented by these bridges must surely come up for consideration Judging from the reports it would seem that not only the piers, but the superstructures of the bridges themselves have served to dam the waters and spill them over the adjoining banks.

If the masonry structures were replaced by suspension bridges or single trusses spanning the entire channel from wall to wall, a great step would be taken toward the prevention of future floods But would Paris, the beautiful, submit to the removal of so many monuments of her architectural genius as are afforded by the present succession of picturesque stone arch bridges.

THE NEW YORK DEEP TUNNEL WATER SUPPLY.

JUDGED from the standpoint of sound engineering and practical utility the plan to carry the new five hundred million gallon per day Catskill water supply through the length of Manhattan Island in one large deep tunnel, cut through the everlasting rock, is one of the most commendable projects ever brought before this city, and we feel that a strong protest should be made against the attempt to discredit this enterprise, which is now being made by certain more or less interested parties.

It is unfortunately a fact that in this age of sensationalism there is no more fruitful field for the panicmonger and scarehead writer than that of engineering works of great magnitude, for such works deal with the stupendous forces of Nature, developing her latent energies on a grand scale, and holding them for beneficent uses only by the curb and bit of technical knowledge and sound engineering judgment. It is the easiest thing in the world, by a little juggling with figures and a large mis-statement of fact, to write a sensational article (or a series of them for that matter), that will lead the lay public to believe that the project under discussion is ill conceived and pregnant with big disaster For a notable instance of this it is sufficient to refer to the agitation against the construction of the Panama Canal on the plans which are being so successfully followed Now, the citizens of New York may rest well assured that the engineers who have staked the city's welfare and their own reputation upon the construction of a huge water-supply tunnel, from one hundred and fifty to two hundred feet below the surface of Manhattan, have not committed themselves to the scheme without the most exhaustive examination of the physical conditions, and the clearest evidence that in economy, durability and public convenience, the tunnel will be a great improvement over the original plan of conveying the water in multitudinous pipes laid near the surface of the ground

The proposed tunnel, which will vary in diameter from 11 to 16½ feet, will extend from Hill View Reservoir near Yonkers, below the Bronx, the Harlem River and throughout the full length of Manhattan Island, and thence, below the East River, to a terminating point near the Atlantic Avenue Station of the Long Island Railroad From this point pipe lines near the surface will extend under the Narrows to Staten Island and northeast into Brooklyn

At the Hill View Reservoir at the north a 300-foot shaft will be sunk, from the bottom of which the great tunnel will be driven to the south It will be constructed at sufficient depth (generally from 150 to 200 feet) to insure its lying everywhere in rock sufficiently solid to withstand, without leakage, the great internal pressure of the water, and as a further safeguard, it will be lined throughout its length with concrete The total length of the tunnel will be seventeen and one-half miles and at 4 000 feet intervals construction shafts will be sunk from the surface When the job is completed these shafts will serve as up-take shafts, with connections to the surface system of pipe distribution

The most valuable advantage of the deep tunnel method is that in Lower Manhattan, Brooklyn and Staten Island, the water will be delivered at a greater elevation by about 100 feet than would be possible if the surface pipe lines were used, and water will be available without pumping on office floors up to a height of 260 feet above tide level This great difference is explained by the fact that the frictional resistance to the flow of the water in the many relatively small surface pipes is largely eliminated by carrying the whole mass of water in one large single conduit. Other advantages are that, since the tunnel can convey as much water as thirty 4-foot pipes, the cost of construction and the annual charges will be about 50 per cent. less, that there will be no interference with subways and sewers, and no opening up of streets during construction or subsequently for repairs, that failure by breakage will be impossible; that there will be a great volume of water at hand in any locality for the control of large conflagrations, and lastly, that by cross-connection of the tunnel with the existing water-supply system, the latter can be safeguarded against any scarcity of supply or other serious emergency

OUR LATEST AND FINAL RECIPROCATING ENGINE BATTLESHIP.

THERE is no denying the fact that the Engineering Corps of the United States Navy view with no little sentimental regret, and a few of them possibly with some practical apprehension, the passing from our navy of that faithful and highly developed prime mover, the multiple-expansion reciprocating, marine engine. But if, because of the ever growing efficiency of the steam turbine, the reciprocating engine is in an advanced stage of obsolescence, it is gratifying to realize that in the United States battleship 'Delaware,' the last of the reciprocating engine battleships, it has shown that in the most important matter of steam economy, it is perfectly well able to more than hold its own, a fact which is highly gratifying, both to the Bureau of Steam Engineering who made the designs and to the Newport News Shipbuilding Company, the builders of the ship who constructed the engines

The "Delaware," which is a sister ship to the North Dakota," is identical with that vessel in everything but motive power She is driven by two vertical four-cylinder, triple-expansion engines, which embody the very latest developments of the type, with piston valves, forced lubrication and high rotational speed. Steam is supplied by water-tube boilers, running under forced draft, and provided with super-heaters, and feed water heaters.

The contract called for the development of 25,000 maximum horse-power and a speed of 21 knots. In the trials the engines developed a mean horse-power, on five runs over the mile, of 28,578 and a mean speed of 21 44 knots. The maximum horse-power developed for a single mile was 30,000, and the maximum speed 21 98 knots Interest, naturally, centered on a comparison of the performance of the "Delaware's" piston engines with that of the "North Dakota's" turbines, and although the turbines drove the ship at higher speed, and with a smaller coal consumption per horsepower, the reciprocating engines of the 'Delaware' showed a superior efficiency at all speeds in the consumption of steam. Now, while superior fuel economy may be and is often affected by the quality of the coal and the degree of skill of the fireman, and, therefore, may be credited more to the stoke-hole than to the engine room, the steam or water consumption is determined almost entirely by the efficiency of the engine, and it is on this last basis of comparison that the engines of the "Delaware" have made such a remarkably fine showing.

In the 24-hour run at 19 knots the 'North Dakota" burned 295 tons of coal, with a water consumption of 16 92 pounds per horse-power per hour, and the "Delaware' 315 tons with a water consumption of 14 52 pounds per horse-power per hour On the 24-hour run at 12 knots the "North Dakota" burned 105 tons with a water consumption of 23 94 pounds, and the "Delaware" 111 tons with a water consumption of 21 08 pounds per horse-power per hour The total water consumed per hour by the turbines of the "North Dakota" at 12, 19, and 21 knots respectively was 76,000 pounds, 238,000 pounds and 349,000 pounds The respective consumption for the "Delaware" for the main engines was 55,000 pounds, 205,000 pounds, and 312,000 pounds. These figures, considered on the score of steam economy, are greatly in favor of the reciprocating engine, and they indicate that the cruising radius of the "Delaware" is considerably larger than that of the "North Dakota"

Why then, it may be asked, is the government committing itself to the steam turbine as the drive for future battleships? The answer is, first, that the "Dakota's" turbines have been greatly improved upon in later models. The number of expansion stages has been increased, and the steam economy has been improved (as shown by recent tests of the Curtis turbine both in England and Germany) until it equals and even exceeds the figures obtained by the best reciprocating marine engine An even more important consideration is the fact that the steam turbine, with fewer working parts subject to breakdowns, is a far more reliable engine It can be driven all day long at the highest speed, without incurring any additional risk of failure; whereas when the reciprocating engine is forced to full power for a continuous run, there is always present, even in the best-constructed engines, the risk that some minor but essential part of the mechanism—a rod, a bearing, etc—may fail and throw the whole engine out of commission

The French Deputies were presented recently with specimens of the new aluminium coinage with which it is proposed to replace the bronze coins in France. The 10 centimes piece is described as "something between a counter and a trouser button," and is said to be even less attractive in appearance than a nickel coin, and to be "ugly and unhandy." The "sou" is much the same, but, of course, rather smaller, and it is expected that both, if they are adopted, will cause considerable confusion.

ENGINEERING.

An experimental road has been constructed at Truro, which it is claimed has the advantages of being resilient, mud and dust proof, noiseless, and requiring no removal of the old surface. It consists in spiking down on the roadway sheets of expanded steel similar to those so largely used for the reinforcement of concrete, and laying over it a 3 inch depth of ordinary road material treated with coal tar, and rolling well in.

The final plans of the new Argentine dreadnoughts have now been passed. The ships will be called "Rivadavia" and "Moreno." They will be of 25,000 tons displacement, and carry twelve 12 inch, twelve 6-inch, and twelve 4-inch guns. The speed will be 22 knots. There will, it is said, be two funnels and two skeleton masts of the new American type. The whole of the twelve big guns will bear on either broadside. The contract for these ships has been awarded to the Fore River Works, and in view of the fact that there was keen competition for this order among the leading shipbuilders of the world, the securing of this contract is a high tribute to American shipbuilding.

A new railroad company has been organized to build a line from Tesiutlan, State of Puebla, through the State of Veracruz, to the port of Nautla, says the Mexican Herald. The $2,500,000 gold capital has all been subscribed, and Engineer Leopoldo Villareal, a member of the board of directors, says that the line will develop a region rich in fruit, sugar, coffee, oil, etc, and that the freight on the lemon trade alone will pay the expenses of the road. A branch line will also be operated between Papantla and Misantla.

According to the United Service Gazette, the first airship for the British navy, which is now being built by Vickers, Sons & Maxim, will be the largest vessel of the kind in existence. It will be over 500 feet in length and driven by two motors of 200 horse-power each, which will be capable of driving the vessel at 45 miles an hour in still air. The nominal lifting power will be 20 tons, although its usual load, according to this authority, will not exceed five tons. It will be of the rigid type as this is considered to be best adapted for naval purposes.

There are over 400 miles of railway now in operation in Guatemala and various extensions are in prospect. One of these contemplates the building of a line from Zacapa on the Northern Railroad, about 100 miles from the sea, to Santa Ana, on the northwestern frontier of Salvador, where it will connect with the British railway already built, and thereby with the capital of Salvador. Much of the coffee now grown in that republic will thus find an outlet to the Atlantic of which it has long been in need, and it is highly probable that the bulk of the import trade to Salvador will also be conducted along this route.

In his first annual report, Secretary of the Navy Meyer asked for only two battleships and one repair ship. These battleships he recommends should be of the "all-big-gun" type. They will complete the squadron of eight vessels of that type. A repair ship is extremely desirable, in order that the fleet may be made more self-sustaining. Mr. Meyer favors the building of practically all the new vessels under contract with private shipbuilding concerns, not only because these industries should be fostered, but also because the construction is more economical when done by private concerns than at the government navy yards.

There is a bill before Congress providing for a bond issue of $30,000,000 for carrying on the work which is now under construction and contemplated by the United States Reclamation Service. A complete description of this noble project for bringing under cultivation arid and semi-arid regions of the West was given in the Middle West Number of the Scientific American of December 11th, 1909. It is expected that by the close of the next year about two million acres will have been reclaimed at a cost of $70,000,000. When the system is completed some thirty million acres will have been recovered and opened for settlement.

We have received the report of the Public Service Commission of the First District of the State of New York, which contains some interesting facts. The number of accidents in street and steam railroads within the city of New York was 56,481 in 1908, while in 1909 the number was reduced to 52,618. The number of persons killed decreased from 444 to 325, which is an encouraging decrease. The service rendered by the transportation companies is now better than ever before judged in proportion to the physical conditions and the volume of travel. This is largely due to the orders of the Commission. The minimum of service is continued a much longer period than heretofore, and the rush-train service has been increased. The matter of adequate service is a serious problem; for during each 24 hours, passengers, equal in number to about 85 per cent of the population must be carried. Fully one-third of all the passengers traveling in one direction during the day are carried in two hours out of the twenty-four.

ELECTRICITY.

The United Improvement Association of Boston is urging the electrification of Boston railroad terminals. It is considered very probable that the matter will be taken up by the Massachusetts Legislature. A rough estimate of the cost of electrifying the terminals and suburban lines is placed at between $50,000,000 and $70,000,000.

The Fifth Annual Electrical Show, which was held in Chicago from January 15th to 29th was unusual for its beauty of decoration. The Coliseum where the exhibition was held was roofed with a canopy of tinsel and ribbons which were lighted up by means of two batteries of searchlights. The colored lights thrown on the gold and silver tinsel produced an extraordinarily splendid effect.

Electric power is furnished to Helsingöre, Denmark, from Sweden by means of a cable which runs under the narrow sea separating the two countries. The power is generated at a 300 foot fall of the Laga River in Sweden and is conducted to the coast by means of cable, where it connects with a submarine cable three miles long. The transmission of power by means of a submarine cable is quite unusual.

A demonstration of the use of electricity as an anæsthetic was recently made in Hartford, Conn., where a patient was thus anæsthetized while four frozen toes were removed from his foot. For the electrodes two zinc plates were used, one applied to the groin and the other to the ankle. During the operation the patient, who was blindfolded so that he would not witness the work of the surgeons felt no pain and chatted and talked in a natural manner. When the operation was over he experienced no after effects.

From time to time estimates of the power of a lightning discharge are published which would give one the idea that every discharge represents an enormous current. On this point Prof. Elihu Thompson, lecturing at Princeton University on "Atmospheric Electricity," recently stated that "we must, however, be cautious not to exaggerate either the current or the potential present in a lightning flash. The current in a flash may at times be only a few amperes or may in a heavier discharge reach perhaps hundreds or approximately in extreme cases some few thousands of amperes. It is doubtful if the potential much exceeds at any time more than a few millions of volts as it is probable that small local breakdowns start the disruptive process which then extends through miles of length."

Following the recent attack on amateur wireless telegraph operators, which has resulted in the presenting of a bill before Congress to limit their activities the amateurs are banding themselves together to resist any action which would interfere with their liberties. They claim that any experienced operator can pick out from a dozen sets of signals sent at the same time the one which he wishes to hear as each operator has his own characteristic method of sending a message which is as easily recognizable as the voice of one man in a crowd. Also that if the professionals care to go to the expense of installing the necessary apparatus they can cut out all the signals except those they wish to receive. While there are many thousands of amateur stations in this country very few of them are capable of transmitting a message more than a few miles and hence the amateur trouble is not to be gaged by the number of amateur stations but only by the number of those few stations which can transmit to over a hundred or two hundred miles.

The new Egner and Holmstrom microphone transmitter was lately given a test on various long distances starting from Stockholm. Conversation could be heard as far as Paris, which is an exceptionally long distance for telephones on the continent, or about 1,360 miles. The transmitter is based on the use of a light steel cylinder or flat box placed between the diaphragm and the carbon grains, so as to press with the flat bottom of the cylinder on a large surface of the grains. It will carry as high a current as one ampere and is thus exceptionally strong. The tests were carried out by the Swedish telephone administration, using a loop which passed through a distant city and then returned to Stockholm and to a subscriber's instrument. Switching in the old transmitter and the new one allowed a good comparison to be made. Speech could not be heard on the standard system, but it could be well heard when the new transmitter was used on lines such as Stockholm-Helsingborg and return, or 1,920 miles. Tests were also made between Stockholm and Berlin, and at this distance 780 miles, speech was as clear as on 100 miles of line on the standard system. Good results were had between the city and Cologne, or, 900 miles, after which the coupling was made with Paris (1,360 miles) via Frankfort and Hamburg. A local line leading from Stockholm to Sundsvall (350 miles) was added to this, making 1,710 miles in all and speech sent from Sundsvall to Paris could be well heard.

SCIENCE.

During the month of January, 1910, four comets were at one time in the heavens. The first of these is Halley's comet, the second Winnecke's, rediscovered at the Observatory de la Plata on October 31st by Poro, the third is Daniel's, and the fourth Inness'.

The Austrian Ministry of Public Works is trying to settle upon a place where radium may be sold, and the price to be charged. The question came up when a quantity of ore shipped from Joachimsthal was found to contain no less than one gramme of radium. The price of this small quantity has been fixed at 380 crowns ($77.14) a milligramme. Those who contemplate purchasing radium may have their addresses entered at the Ministry of Public Works in order to receive information as to quantities and current prices of radium.

Dr. E. G. Acheson was presented with the Perkin medal at a recent meeting of the Chemists Club. In presenting the medal Prof. C. F. Chandler traced the history of the decoration and told how it had been conferred upon Sir William H. Perkin, Dr. J. B. Francis Herreshoff, and Dr. Arno Behr. Dr. Acheson received the medal for discovering entirely new materials suitable for many purposes and now indispensable to the world. The substances with which Dr. Acheson's name is associated are carborundum, deflocculated graphite, and Egyptianized clay.

The New York Aquarium had a greater number of visitors during the year 1909 than ever before, the attendance being 3,803,501 an average of 10,417 a day. These figures show that the Aquarium has a greater patronage by the public than all the other museums of the city including the Zoological Park combined, and 1,800,000 more, for the same period than the New York Hippodrome which has probably the largest attendance of any theater in the city. These figures are unequaled by those of any other museum in the world of which statistics are available.

The first spectroscopic observations of Halley's comet, made at Meudon by Deslandres and Bernard, reveal clearly marked discontinuities in the spectrum of the comet. The faint continuous spectrum is crossed by distinctly stronger lines especially in the ultraviolent region. On December 6th the comet showed a nearly circular nucleus from which extended two curved rays of feeble brilliancy, but distinct, and resembling in form the antennæ of an insect or the prongs of a two-pronged fork. The direction of these rays was such that it appeared scarcely possible to attribute them solely to the repulsive force of the sun. On the following day these appendages were no longer visible and the general brightness of the comet appeared to be diminished. These first observations show that the comet is already self-luminous and that its light is due partly to incandescent gases.

An asteroid, which appears to be a previously unrecorded member of the family, has been discovered by Boinot of the Paris observatory. In examining a photograph made on October 19th Boinot observed a faint linear trace. As the star images on the plate were perfectly round and sharp, it was evident that the trace was either a defect in the photograph or the impression made by a planet. In order to verify the observation, another photograph of the same part of the sky was made on October 23rd. The second plate showed the trace, a little to the southwest of its former position. It was, therefore, certainly due to an asteroid, which appeared to be of the eleventh magnitude. The discovery was immediately reported to the astronomical bureau of Kiel, where the asteroid was provisionally designated by the symbol 1909 J D. Since the remarkable discoveries made by the Henry brothers the search for asteroids has been carried on almost exclusively by German and American astronomers.

The French journal Le Radium describes a long series of experiments made by Blanc, of Rome, in regard to the presence of thorium in various earths and rocks. The proportions of thorium found expressed in millionths of the weight of the mineral, were as follows: Roman vegetable earth, 14.5, granite from the Vosges Mountains, 20.7, granite from Lake Maggiore, 31.4, various specimens of syenite, 63.0 to 82.8. The experiments of Joly relating to the rocks of the St. Gothard tunnel, gave the following quantities of thorium (in millionths) 5.10 in the weathered sedimentary rock near Tessin, 11.8 in the schists and 16.5 in the granite and gneiss of the Finsteraarhorn, but Joly found also similar quantities of uranium and about 1 ten millionth as much radium. The inference is that thorium exists everywhere, in all rocks, in sea water, etc., and it appears not unlikely that with the aid of sufficiently exact methods, it would be found in all substances. Blanc has calculated the quantity of heat disengaged by the thorium compounds in the rocks and has found it twice as great as the heat produced by the elements of the uranium-radium family in the igneous rocks which were examined by Strutt. Hence it appears that thorium must play a considerable part in the radioactivity of the earth.

A NEW STORAGE BATTERY STREET CAR

ANOTHER EDISON INVENTION.

The announcement was made about nine years ago that Thomas A Edison would soon place on the market a storage battery that would be much lighter and of greater capacity than the usual battery and provided with positive and negative elements that would not deteriorate because in place of an acid an alkali would be used for the electrolyte Much was promised for this battery, and a year or two later it appeared The positive element consisted of nickel oxide interspersed with layers of graphite and packed in perforated nickel tubes, while the negative element consisted of iron oxide and the electrolyte was potassium hydrate Both elements were supported in nickeled steel grids The battery weighed about half that of the usual storage battery of the same capacity It showed no serious effect when rapidly discharged, and no damage resulted from overcharging Shortly after the batteries were placed on the market it was found that the graphite became oxidized and interfered with the output. After considerable research it was discovered that chemically pure nickel could be substituted for the graphite and would not become oxidized in use But soon another difficulty developed The nickel was packed in tubes of square cross section and these tubes would buckle or bulge outward, permitting the powdered nickel oxide to filter down over the pure nickel layers and insulate them Then it was determined that a round tube would have to be used which would withstand the pressure of the nickel oxide The problem of producing such tubes economically was a serious one. They had to be about the size of a lead pencil, namely, quarter of an inch in diameter and four inches long, with the sides finely perforated. A machine was eventually built which made the tubes out of perforated nickel ribbon. The ribbon was wound spirally with the edges of the coils interlocked and fastened together during the coiling process. A vast amount of money was spent in solving this one problem of the battery.

Shortly after the batteries were first put on the market they were withdrawn on account of the defects above enumerated, and about two years ago when the battery was finally completed in its present form a large number were sent out to be tested on auto-

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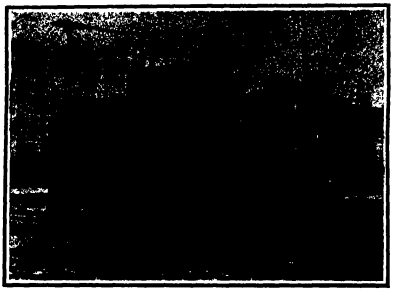
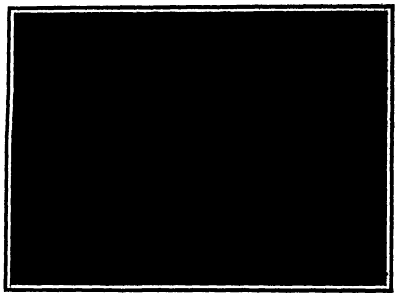


The car weighs but five tons complete and its construction represents a radical departure from common practice



Interior of the car with the seats raised to show the batteries placed in the steel girders.

A NEW STORAGE BATTERY STREET CAR.

ARTIFICIAL PRODUCTION OF THE VOICE

BY JACQUES BOYER

Dr Marage has succeeded in demonstrating, by numerous experiments, that the voice results from an intermittent vibration of the larynx and the air within it, reinforced by the resonance of the mouth and other cavities situated above the larynx In a recent communication to the Paris Academy of Sciences, Dr Marage supplements this demonstration by proving that the larynx alone suffices for the production of these vibrations In the first of these later experiments, performed on a living person Marage succeeded in nullifying the action of the buccal cavity by filling the mouth with "steut," a substance which is used by dentists for obtaining impressions of the mouth The steut which filled the mouth was traversed by a rigid tube which connected the larynx with the external atmosphere Although the resonant cavity of the mouth was thus suppressed, the five laryngian vowel sounds OO, O Ah, Ay, and Ee, were enunciated distinctly by the larynx alone

The investigation was continued by endeavoring to produce vocal sounds from a larynx detached from the body Muller had already experimented with the dead and isolated larynx, but the sounds which he obtained were quite different from those of the living larynx, and he stretched the vocal cords by applying forces much greater than the muscles of the larynx can exert These forces, which in some cases exceeded a weight of 2¼ pounds, would certainly have torn out the arytenoid cartilages of a living human larynx. Hence the conditions of Muller's experiments were abnormal

Marage employed, in his experiments, the larynx of the dog In order to spare the animal useless suffering, morphine was first administered hypodermically and, three hours later, the dog was put under the influence of chloroform, and the larynx, with five or six rings of the trachea, was excised. A rubber tube of the diameter of the trachea was then connected with the latter by means of a short tube of thin glass, so that a current of air could be forced through the extirpated larynx. The pressure of the air was measured with a very sensitive metallic manometer graduated in millimeters of water pressure. The compressed air was stored in a rubber bag similar to those which are employed for inhalations of oxygen, and was kept at the temperature of 98.6 deg. F. The muscles of the larynx were stimulated by the current of a small induction coil, which was energized by a storage battery, and the sounds

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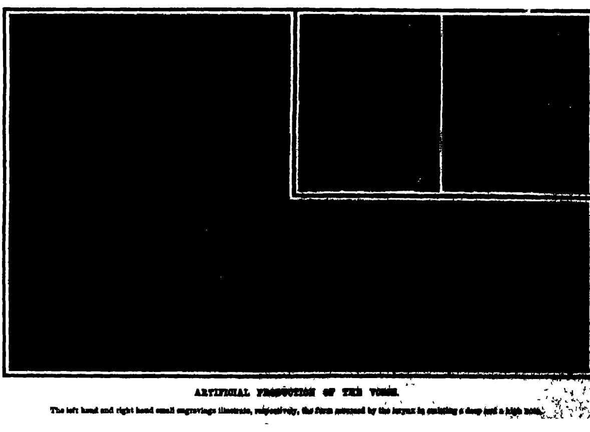


ARTIFICIAL PRODUCTION OF THE VOICE.

The left hand and right hand small engravings illustrate, respectively, the form assumed by the larynx in emitting a deep and a high note.

WHAT SMOKELESS POWDER HAS MADE POSSIBLE.—I.

BY ROBERT G. SKERRETT

Except for saluting purposes, where smoke making is a factor in the ceremony, smokeless powder has supplanted the older propellants.

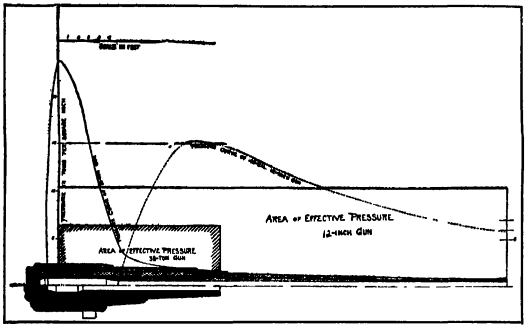
Our biggest battleships could not be given their present powerful armaments had not smokeless powder made it possible to add to the destructive force of our guns while calling for much less weight per unit of energy than formerly

Smokeless powder was first generally used in the French navy at the time of the devolpment of rapid fire guns to repel the swift torpedo boat The use of smoky gun powder in those weapons would have blanketed the defensive vessel in a cloud and have given a greater chance of success for the torpedo boat Thus, a military necessity demanded the change Once developed, however, smokeless powder became the stepping stone to a revolution in ordnance engineering This was due in the main to the differences between the physical actions of the old and the new propellants.

Black gun powder has a very dignified antiquity It is a mechanical mixture of saltpeter, charcoal, and sulphur Smokeless powder, on the other hand, is a chemical combination in which the atoms bear a different and a far more intimate relation to one another Common gun powder is a violent explosive and generates its gases with great suddenness Its grains, however, when burned in a confined space are only imperfectly consumed, and large volumes of smoke are generated. When used in guns the products of this combustion give about 40 per cent of propelling gases. These propulsive gases have the double burden of moving the shell and this inert mass of smoke and unburned grains.

Prior to our adoption of smokeless powder, the charge was about half the weight of the projectile—double the quantity of smokeless powder required to give the same ballistic results Black powder exerts a very great and disproportionate stress upon the breech of the gun. Thence toward the muzzle, the pressure drops suddenly—especially if the grains be small and the mass thus easily inflamed Our diagram shows graphically the quickness with which the highest pressures are developed and the rapid way in middle of these units so that as the consuming flame reduced the outer surface the burning area of the hole was increased, maintaining thus a relative balance of ignited surface and giving a more regular and gradual dealing with the briefest fractions of a second of time, but measurable intervals that mean everything to the ordnance engineer

Higher velocities and better ballistics followed But



	Armstrong Gun.	U. S. Navy Gun
Caliber	12.5 inches	12.0 inches
Length of bore	198 inches	546 inches
Weight	38 tons	52.9 tons
Muzzle velocity (per second)	1,400 feet	2,950 feet
Maximum pressure	23.8 tons	15.8 tons

	Armstrong Gun	U. S. Navy Gun
Minimum pressure	6 tons	5.79 tons
Average pressure	6.37 tons	10.40 tons
Powder charge	130 pounds	375 pounds
Weight of projectile	820 pounds	870 pounds

Comparison of construction, powder pressures, etc., of the old Armstrong and the latest 12-inch navy gun.

generation of gas. For a time, this answered But the gun grew, and the exposed surfaces of the greater powder charge required offered too large an initial burning area, and dangerously high and sudden pressures were produced at the breech of the weapon. there was actually more smoke than before, the bores of the guns were quickly fouled and there still remained a wasteful percentage of unburned grains Such was the state of the art in this country when we went to war with Spain

Weight of gun, 63 tons; Weight of shell, 1400 pounds; Powder charge, 365 pounds; Muzzle velocity, 2,600 feet per second, Muzzle energy, 65,687 foot-tons.

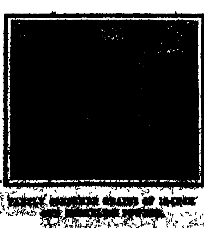
THE NEW 14-INCH, 45-CALIBER GUN NOW UNDERGOING TEST FOR THE NAVY.

which they fall—the average propulsive force being but a low percentage of the maximum power evolved It is this average pressure that sends the shot on its destructive errand, and the aim of the ordnance engineer is to have this reasonably high while lowering the crest of the curve of maximum energy

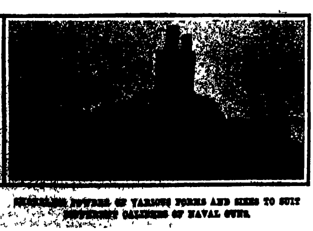
The first remedy tried was in the form of larger grains, so that, for a given weight of charge, the superficial area at once exposed to the flame should be reduced—the powder instead of going off with a single flash burned more slowly, and the propelling force was better distributed along the bore of the gun. This method led to the making of prismatic grains up to an inch and a half in diameter—regularly and carefully formed. Next, a hole was bored through the Besides this, a big percentage of the grain was blown out of the gun unconsumed Advance for a time was blocked until the powder makers evolved a "slow-burning" propellant by changing the proportions of some of the ingredients. The purpose of sulphur is to lower the ignition temperature of the powder, and by lessening this element inflammation was momentarily retarded By increasing the charcoal a greater percentage of moisture was added, and that served as a slowing-up agent in the general combustion of the mixture. The powder thus developed was called "cocoa" because of its color—the consequence of the undercharred charcoal used. In this country, we later called it "brown prismatic." The terms "quick" or "slow burning" are merely relative In either case we are

Smokeless powder has quite reversed the task of the ordnance engineer His aim now is to provide an explosive which can be made to suit the gun rather than to fashion the weapon to meet the violent vagaries of the older propellants Our present smokeless powder generates a relatively low regular, and progressive pressure from the instant of ignition up to the time the shot leaves the muzzle of the gun with its maximum velocity The curve of our big 12-inch rifles shows how much nearer the powder makers have come to solving the problem, but much patient experimenting has yet to be done before the ideal is measurably approached

The operative cycle of a shot moving along the bore of a gun is exactly opposite to that of a train of cars gaining full speed from a standstill In the latter case, the engineer knows that he would endanger his couplings—even if he did no other damage—if he opened wide the throttle at the instant of starting So he begins by just acquiring headway and then gradually increases the motive energy until the train has reached full speed—a matter of quite several minutes for a fast train and during a distance of a mile or two. The ordnance engineer, on the other hand, can give to his projectile only a flying start by suddenly applying a great and violent pressure, and enough of this propulsive force must follow the shell to the muzzle in order to give the desired maximum velocity This must be accomplished within a period of not more than one-hundredth of a second of time and in our biggest guns, while the shot travels a distance of not more than fifty feet A few figures will enable us to realise better the task set the ordnance engineer and



[illegible] GRAINS OF 12-INCH [illegible] POWDER.



SMOKELESS POWDER OF VARIOUS FORMS AND SIZES TO SUIT DIFFERENT CALIBERS OF NAVAL GUNS.

the part that smokeless powder plays in the result when measured by the power to strike an appalling blow. The shell leaves the muzzle of one of our latest 12-inch, 45-caliber rifles, with a velocity of 2,950 feet a second—33.52 miles a minute—and has a striking force at that instant equal to a blow of 52,632 foot-tons! A fast express of 350 tons, thundering along at the rapid rate of 98.34 miles an hour in collision with a standing object, would be able to deal a blow of exactly corresponding magnitude. The gun's missile weighs but 870 pounds and the charge of powder 335 pounds—such is the power concentrated in our smokeless propellant, and yet so wonderfully regulated is the development of this stupendous energy that the weapon is actually less taxed than the older 12.5-inch rifle dealt with in the diagram while the present-day gun has far more military value.

Referring to our diagram we see how far smokeless powder has made it possible to improve upon the performance of the Armstrong gun of the "eighties." That gun fired a shell of 820 pounds, used a charge of 130 pounds of black powder and gave to its shot a muzzle velocity of 1,400 feet a second. At the instant the shot left the gun it had a striking energy of 10,980 foot-tons. To-day our big 12-inch rifles weighing but forty-odd per cent more than the older weapon, can send their 870-pound armor-piercing shell on an errand of destruction with an initial speed of nearly 3,000 feet a second—delivering at the muzzle a blow nearly five times as great as that of the Armstrong gun. The 38-ton gun with a powder charge scarcely more than a third of that now used, developed the dangerous maximum pressure of 24 tons to the square inch in the powder chamber. Our big "twelves"—using 365 pounds of smokeless powder—have a maximum chamber pressure in service of not more than 16 tons. This means a reduction of stress upon the breech of the weapon of quite 33 per cent and yet yielding an average propulsive pressure of something more than 60 per cent greater, all because the present powder burns slower and exerts its driving power for a longer period during the passage of the shell along the bore of the rifle. It is the difference between the shock of a single, sudden, violent impulse and the better-sustained push by which an object may be set in motion and accelerated.

Surely these are truly astonishing strides, and yet so unobtrusively have they been made from year to year that but few of us have realized their extent and their significance in strengthening our powers of defense and of retaliation. Such are the achievements of to-day! What may we not expect to-morrow?

(To be continued.)

A NEW UNITED STATES NAVAL GUN OF GREAT POWER.

Our illustration of the new naval 14-inch gun cannot fail to excite widespread interest among those who are following the trend of development in the United States navy. The piece was constructed at the Midvale Works from plans of the Bureau of Ordnance, and received its finishing touches in the naval gun shops at Washington. It is now undergoing tests at the Indian Head Proving Ground which are giving much satisfaction to the officers of the Bureau.

There seems to be a growing conviction among some of the leading naval powers that, in view of the fact that future engagements will be fought at long ranges at which the remaining energy increases greatly with an increase in the size of the gun, future dreadnoughts will be armed with a piece of larger caliber than twelve inches. Great Britain is building, if she has not already completed, a 13½-inch gun, and our 14-inch piece has been designed and is now being tested, with a view to putting our navy in a position to arm future dreadnoughts entirely with the 14-inch if it should be deemed desirable to do so.

The new weapon, which will be 45 calibers in length (that is to say its length will be 45 times the bore), measures over all 53 feet 6¼ inches, and it weighs 63 tons. It fires a projectile of 1,400 pounds weight with a charge of 365 pounds of smokeless powder and the shell leaves the muzzle of the gun with a velocity of 2,600 feet per second and an energy of 65,687 foot-tons. It will be noticed that the velocity is 350 feet a second less than that of our latest 12-inch gun, but that because of the heavier shell the muzzle energy is greater. The lower velocity has the great advantage that the pressures and temperatures in the bore of the gun will be less and therefore the erosion will be reduced and the life of the gun before the rifling is so badly worn away as to destroy the accuracy will be considerably longer. The method of construction is generally similar to that shown in the accompanying article entitled "What Smokeless Powder Has Made Possible"; and, except that the powder pressures are lower, the curve of pressure from the powder chamber to the muzzle is approximately the same for the two pieces.

The telescope which is being installed in the Transvaal Observatory will be the second largest in the British Empire. It will be 36 feet long and have an aperture 26 inches in diameter.

The Rockefeller Institute's Work on Infantile Paralysis.

BY JOHN B. HUBER, A.M., M.D.

The psychic machinery in our body is made up of two systems—the cerebro-spinal and the sympathetic, the latter does not here concern us. The cerebro-spinal system is made up of the brain, the spinal cord and the nerves, which are derived from the cord and extend thence to the muscles, the skin, and the uttermost tissues. The basis of this nervous system is the neurone, composed of a cell body (gray matter), and its dendrites or fibers (white matter) which emanate from the cell like the roots of a tree. The neurones are sensory and motor, and infantile paralysis is an affection of the motor neurone. The whole is like a telegraph system. The fibers (which make up the nerves) are the telegraph wires, the cell bodies (as grouped in ganglia) are the telegraph stations, communicating by their fibers with the extremities, with one another, and with the main office in the brain cortex.

The sensory ganglia in the spinal cord, to which sensations are telegraphed from the surface of the body, are in the posterior "horns", thence the sensations are transmitted to the brain cortex, from which in return commands are sent down through the motor ganglia, in the anterior horns of the spinal cord to the muscles working the affected area.

Infantile paralysis is known also to physicians as anterior poliomyelitis (*polios* gray, *myelis*, marrow—a term applied no doubt when the gray matter was erroneously supposed to be marrow, and *itis*, inflammation). So this disease is an inflammation of the anterior horns in the spinal cord—those parts of the cord which are concerned in muscular movements and development, and such a lesion means paralysis, atrophy or degeneration in the particular muscles innervated from the part of the cord involved.

Infantile paralysis is generally an acute disease, and by far the greatest sufferers from it are little children from one to five years of age. Apart from the pathos in this circumstance, we would infer (though not, of course conclusively) the infectious nature of this form of paralysis. For almost all the acute infections—measles, scarlet fever, whooping cough, and the like—are generally diseases of childhood, adults and the aged seldom contract them, if they have once contracted them in childhood, because the attack in infancy has conferred in most cases, lifelong immunity upon the individual. Another reason for inferring infectivity in poliomyelitis is its frequently epidemic character, as in the summer of 1907, when nearly the whole Atlantic seaboard was swept, and again in the summer of 1909, when the disease appeared in New York and spread widely throughout the United States and Europe.

In perhaps two-thirds of the cases that have been studied physicians have concluded them to be infectious, though they could not prove this, in the remaining one-third the disease has been attributed to falls, to antecedent maturing fevers, and to hemorrhages into the spinal blood vessels. In the light of our present knowledge, however, it is safe to consider that such falls fevers and hemorrhages have not been causative of the poliomyelitis but rather predisposing factors making the tissues concerned vulnerable to the essential or specific virus.

The motor neurones in this paralysis become smaller, then they degenerate, liquefy, and finally shrivel up, the fibers emanating from them degenerate and atrophy. This process may go on to complete destruction of these precious elements, or it may be arrested at any stage. If arrested early, repair may ensue and the cells and their fibers regain fairly well their normal condition and function. If, unfortunately, the inflammation goes on, the size and shape of the spinal cord at the points involved are contracted and changed, and in consequence of this the muscles concerned become paralyzed, atrophic, and incapable of their proper function. When recovery does take place these muscles are apt to remain small, perhaps throughout lifetime. These little patients suffer also retarded bone growth deformity of the joints involved sometimes lateral curvature of the spine, sluggish circulation, and impaired nutrition.

Such an illness begins suddenly with a high temperature and all the symptoms accompanying a fever; there is a pain in the back and limbs; suddenly there supervenes paralysis, generally in the leg muscles. A child may be put to bed seemingly quite healthy, and may in the early morning manifest these sufferings. The outlook is generally good as to life itself, yet the severity and fatality of the disease, as in all infections, fluctuate widely; and taking it all in all, poliomyelitis is sufficiently disastrous to give medical men much anxiety, as it should give the community in general grave concern.

As intimated, the infectious nature of poliomyelitis has been rather assumed than proved; it would now seem that complete demonstration of infectivity will presently be forthcoming. We may then entertain the confident hope of a preventive and immunizing agent against infantile paralysis akin to that which has practically eliminated smallpox from human experience. Early in 1909 two German experimenters, Landsteiner and Popper, successfully inoculated two monkeys with the spinal cords taken from two fatal human cases of poliomyelitis. In both the monkeys lesions of the spinal cord were on autopsy found similar to those in man.

In September of 1909 Dr. Simon Flexner and his colleague, Dr. Paul A. Lewis, of the Rockefeller Institute, in New York city, obtained the cords of two children that had unfortunately died of poliomyelitis, in which cords the anterior horns exhibited the characteristic gross and microscopic appearances. Transmission was then made to monkeys. After ether anesthesia inoculation was made in the brain of these simians through a small trephine opening. The injected material consisted first of emulsions in salt solution of the two human cords; and later of emulsions of the spinal cords of the monkeys that had developed paralysis after injection of the first emulsion, that from the human cords. The spinal cords in six series of monkeys thus inoculated showed without exception lesions similar to those of human poliomyelitis.

Now, a single successful inoculation with human virus resulting in experimental poliomyelitis could not establish the scientific case here set forth, because the result might have been due to a transferred toxic body, but in the experiments of Flexner and Lewis the transfer of the active agency of epidemic infantile paralysis was regularly successful. In one series of seven monkeys the first inoculation was of human virus, the other monkeys were successively inoculated each with the virus from the cord or the cortex of its predecessor, the disease regularly resulting. Hence, by these and other equally conclusive experiments, one cannot doubt the infectious nature of poliomyelitis.

Again, later injections were made, not only in the brain of monkeys but also into the abdominal cavity, the blood vessels, into nerve substance (as in the sciatic) of these animals. Nor "can it yet be affirmed that still other avenues of infection (as the skin, the organs of respiration or the digestive tract) do not exist, for the entrance of the virus into the central nervous system."

But now as to the nature of this virus which is responsible for infantile paralysis. It is at present in visible under the microscope. Flexner and Lewis after most exhaustive search, have found that it is neither a bacterium nor a protozoon, which parasites have been isolated as pathogenic of most of the infectious diseases. The virus of infantile paralysis—its infecting agent—is of the same nature as that of smallpox, it belongs to the class of the minute and filterable viruses that have thus far not been demonstrated with certainty. Nevertheless, although the smallpox virus still remains invisible to us, for a century past a vaccine has been evolved from it by which we have practically banished this dreadful disease from the face of the earth, there should then be no reason in science why a vaccine or an immunizing agent against poliomyelitis should not now in good time be forthcoming.

By the way, did the reader note in this paper the phrase "after ether anesthesia?" It means that the monkeys suffered no torture during these experiments, so beneficent in their trend for humankind. Let us congratulate ourselves that infantile paralysis is another added to the long list of dreadful diseases for which a remedy is being found through animal experimentation, which could otherwise never have been evolved.

An Electro-pneumatic Conveyor System for Libraries.

An electro-pneumatic system is used in the Berlin royal library for carrying out the distribution of books to the readers. Upon this system the reader fills out a blank containing the name of the desired book, and upon this blank an employee writes an exact indication of the place where such volume is to be found. The bulletin is then sent by pneumatic tube to the central office. This office is directly connected by elevators with the different stories of the building. These elevators are of small size and are operated electrically on a push-button system. Besides, there is a large elevator running through all the floors for transporting persons and books. A set of pneumatic tubes also run from the central office to the different floors which contain the books. The employee of the central office who receives the reader's bulletin sends the same by pneumatic tube to the proper floor, and on this floor the attendants read the sheet and bring the desired books to the elevator which takes them to the central office. This latter office then sends the books to the point from which the bulletin was sent in the first place, either in the main reading room or any other of the rooms of the library.

The production of mercury at the Almaden mines, Spain, was 1,017,[illegible] kilos, or 29,[illegible] flasks, in 1908. At Alcaraz it was [illegible] kilos.

Correspondence.

THE GYROSCOPE AS A CLOCK.

To the Editor of the SCIENTIFIC AMERICAN

In regard to Mr. Baker's item in the January 1st number relating to the gyroscope not maintaining its position relative to the earth, but relative to a fixed point in space, if this be true, the gyroscope, operated by a small motor and set on a balanced pivot, would make an excellent timepiece, although slightly different from those in present use, make only one revolution in 24 hours The clock would of course have to be set with the axis north and south, so the gyroscope would (apparently) rotate from west to east. It could also be geared so as to denote the minutes and seconds, and would be absolutely accurate, with the exception of the slight friction which would have the effect of slowing the clock a trifle

It occurs to me also that the same principle might be made use of in maintaining the position of astronomical telescopes, if the vibration could be overcome, instead of the mechanical, clockwork devices now in use.

To anyone who has the inclination to experiment in this way, a timepiece of this character would make an interesting toy, and could be very cheaply constructed An ordinary toy electric motor should serve the purpose of a gyroscope CARL OPSTHUN

Edmonton, Alberta.

WHY DOES A WATCH-SPRING BREAK?

To the Editor of the SCIENTIFIC AMERICAN

Why does a watch spring break after being in use quite a while? *If not strong enough, why did it not break at the very beginning?*

Such is the question propounded by the Editors of the SCIENTIFIC AMERICAN

Let us suppose a strip of iron to be fastened at one *end, the other end being free If we bend it a little* and then let it go it will return to its place after vibrating a certain length of time It may do the same again and again, when we bend it more and more until finally after being bent beyond what is called the limit of elasticity, it will be permanently deformed Its molecules have then assumed a difficult position in regard to each other from that they had before

If we keep on bending it still more it will finally break in two at the point where the strain is greatest or where a defect may exist

Now let us try a good steel spring Here we find no deformation appreciable When we bend it beyond its strength, it snaps at once At least it appears to be so The probability is, however, that a permanent bending takes place first but at a point so near the breaking point that the difference escapes our observation entirely

Passing to the other extreme we will take a strip of lead There is then almost no elasticity, a very slight bending will deform the piece, but on the other hand, it will take a considerable amount of bending or twisting to break it

So much for the immediate effects of bending or otherwise straining any given material But now the question arises, what might be the effect of a strain not quite sufficient to produce an immediate deformation, but applied during a long time?

I can give here an example that I have often the occasion to verify Take a piece of tin and a piece of zinc (in sheet) of the same size, bend them to some extent and fasten them Two weeks later release them The tin will return immediately to its former shape while the zinc will remain bent just as it was fastened

Or take a piece of tar and put it on the table It will keep its shape, and even stand quite a pressure without deformation or breaking down Nevertheless in the course of a few days its molecules will have yielded to such an extent that the piece of tar has not even been able to stand its own weight, and has spread over the table

Now, what has taken place with the zinc or the tar undoubtedly occurs with the other materials within certain limits, at least it seems to me so The piece of iron kept bent near the point of immediate deformation, must in a sufficient time yield and be deformed The watch spring, or other steel spring, kept bent not quite enough to break must in course of time break up. The continued tension of the molecules must have a tendency to displace them, and finally causes them to yield

We have an immense amount of information as to the immediate deformation or breaking of materials of all kinds under stresses applied at once or during a short time, but only very little concerning the effects of stresses applied during a long time. Several suspension cables or bridge steel members have given way after years of service. The general opinion among engineers is that the breaking was due to the vibrations caused by the travel over the bridges, These vibrations caused the molecules of the steel or iron to assume a crystalline structure instead of the original fibrous disposition

It is said that a watch spring is more liable to break during warm than during cold weather I am very much tempted to question the correctness of that opinion However it may be so to some extent at least

In the first place, as a general rule the strength of all metals decreases with an increase of temperature Between the ordinary limits to which a watch is exposed, the difference is insignificant But it is not so as to the expansion of volume The diameter of the barrel changes but very little, but the spring, being very long, expands out of all proportion In fact the increase of length of the spring is about twenty five times the increase of size of the barrel

That is the equivalent of placing the spring in a smaller barrel and increasing its tension and liability of breakage in proportion ADRIAN GFTAZ.

Knoxville, Tenn

SAFETY IN MINES.

To the Editor of the SCIENTIFIC AMERICAN

In your issue of December 4th, 1909, in an editorial discussion of the Cherry mine disaster you state "the flames reached the dust-covered pine timbers of the structural work" This leads to a suggestion that the structural work in coal and other mines should not be made up of pine or other timber at all, but of iron or steel Also, from another part of your discussion I conclude that ventilating shafts should be distinct from the hoisting shafts.

In fact, the whole subject of protection to the miners should be studied out by scientific mining experts The duty to protect the workmen rests as moral duty *on the owners and operators of the mines* and this moral duty is in need of legal enforcement by appropriate statutes State and federal The men are clearly entitled to protection, and protection would in the long run pay in dollars as well as lives

The whole subject of protection from preventable disasters—and most of them are preventable as is generally discovered after the event—needs to be made the subject of expert scientific study The loss of life and limb due to accidents in mines, in railways and to burning factories theaters school houses and hotels is appallingly great, the more so when much of it, most of it, is clearly preventable But right here it must be emphasized that too much reliance is had on mechanical signal systems such as block signals on railways and the like No mechanical system can obviate the need of supplementary personal human vigilance There must be still the human watchman to supplement the mechanical system Mechanical systems have their advantages—the advantages of automatism But automatism needs the aid of human intelligence and vigilance There is too little value placed on human life - the lives of workmen, of travelers of the spectators at the play, of the children in the great crowded school houses The man who sees his loved ones start on a journey is likely never to see them again, or at best (or worst) their charred, almost unidentifiable remains Or if they live, it is to be maimed, disfigured cripples. Or the man himself may be stricken in his prime—the untimely victim of a lack of care or of undervaluation of human life Or the president of the railway system—as has happened more than once in the last decade—may himself become the victim of his own neglect and may ride to death in his palatial special

The whole matter of accidents is in a condition unworthy of the intelligence of the country For one thing, there is lack of constant inspection—eternal inspection, day and night There seems to be an unwarranted confidence in wood, iron and steel, a gratuitous assumption that accidents are not likely to happen The proper wiser assumption is that they are sure to happen unless forestalled They certainly do happen But somehow they do not seem to be taken into serious account The plans for running railways, mines, and factories leave the certainty of accidents too much out of consideration, as if they were mere "sports" of Nature, mere chances, whereas they are the certain and inevitable and hence preventable results of well known factors—factors of wear and tear, factors of growing structural weakness in timbers and steel, factors of over possible congruity of unfavorable circumstances, the incidental coming together of combustible elements etc

In hotels it must be assumed that fires are likely to happen at any or all times, and there is need of the eternal vigilance of a sufficient number of trained brains to keep the whole area of danger under intelligent surveillance Mechanical appliances should not be regarded as a substitute for these living inspectors but merely aids. For the automatic system has a canny, unmechanical way of getting "out of fix" at the worst possible time Indeed it can be depended on to do this very thing. These observations apply to railways, mines, and factories It is not sufficient to have a jury determine whose negligence caused the accident or to say that it was due to some imperfection in the automatic signals Prevention is the thing Think what horrible deaths—deaths of scalding, burning, crushing, maiming—American men, women, children and babes are dying almost hourly The sickening scene is familiar—the 'unlooked for accident—the sending for the nearest village or town surgeons, the "carting away," the "shoveling up" of the mangled remains, the horrible identification of charred remains by some jewel or scrap of a shoe or fragment of apparel Prevention is the thing through expert scientific study and adequate inspection The subject is of enough importance to warrant it being taken up in the great universities and technical schools, so that men could be trained by proper study and practice to take charge of the important work of saving life by preventing accidents It would be a noble and useful work, if achieved—and it can be achieved Railroads or railways systems should have a department with a trained corps of men to cope with these conditions out of which accidents arise At its head a competent man, not to operate trains, but to remove the dangers of accidental death sure to arise when all are bent on running the trains on schedule (as now) and no one is thinking particularly of the human lives entrusted to the railways system, *these dangers* would be greatly minimized if the right steps are taken There is a railway west of the Mississippi River that has been operated for several decades, and it enjoys this unenviable distinction The road has never caused a single human death I have heard also of a steamship line that has never lost a passenger's life This shows what is possible If these conditions were general how much happier everybody would be E L. BLACKSHEAR,

Fellow American Association for the Advancement of Science

Prairie View, Tex.

Ephemerides of Innes' Comet.

In order to determine early positions of Comet 1910 *a* on photographic plates, the following ephemeris has been computed by Prof O C Wendell from Kobold's element, given in H B 383

EPHEMERIS

G M T			R. A		Dec		Log R	Log Δ
		h	h	m	Deg	M		Δ
1909.	November	29 5	14	58	+16	17	0 1567	0 1774
	December	9 5	15	38	+17	2	0 0874	0 1118
	December	19 5	16	23	+20	39	9 9987	0 0[illegible]
	December	29 5	17	15	+17	46	9 8701	9 9758
1910.	January	8 5	18	18	−0	31	9 6375	9 9878

From the same elements, Mr F E Seagrave has computed the positions given below

EPHEMERIS

G M T		h	R. A		Dec		Log R	Log. Δ
1910.	February	8 0	22	6	+15	56	9 8810	0 0618
	February	7 0	22	26	+18	59	9 8967	0 1100
	February	11 0	22	39	+23	18	9 9603	0 1[illegible]
	February	15 0	22	53	+26	49	9 9966	0 1657
	February	19 0	23	6	+29	54	0 0840	0 1991
	February	23 0	23	19	+32	38	0 0598	0 2174

The Current Supplement

The great bridge over the Red River in Indo-China is the subject of an article which opens the Current Supplement No 1779 Mr Richards explains some principles in design of friction clutches A new valve gear for gas engines is described and illustrated. An automobile chart has been invented by Mr Joseph J Jones which serves the functions of a mechanical sign post Briefly the invention is a revolving card which tells the driver or any one in a car exactly where he happens to be upon a road An article on the German "Dreadnoughts' of the 'Nassau' type is published A Lottermoser discusses the present state of physical chemistry in colloids Dr G Hudson Makuen writes on stammering and gives some suggestions as to modern methods of remedy J T Cunningham writes on transformations and migrations of eels Most of us have probably never heard of Nicole Oresme, yet he was the forerunner of Copernicus Prof Pierre Durham does credit to his work in an appreciative article A very exhaustive article on the Paris tunnels will be found in the SUPPLEMENT, an article of peculiar interest in view of the recent inundation of the French capital

The depth of the water in the middle of the Berlin-Stettil Canal will be 3 meters (9 84 feet), and the breadth at the surface in ordinary soil 33 meters (108 24 feet) In soft peaty ground it will be from 37 meters to 38 meters (121 4 to 124 6 feet) For a distance of 16 miles the bed and banks of the canal will have to be puddled with clay, the surface of the canal there being above the water level of the surrounding country At one point the canal crosses the valley of the river by an embankment provided with a culvert 160- meters in length The eleven locks for the descent into the Oder Valley are begun One of them has a fall of 9 meters (29 52 feet) The question of building a lift besides the series of locks has not yet been decided The 37 canal bridges are all to be built of steel

CLEARING SNOW FROM RAILWAY TRACKS IN CANADA.

BY FRANK C. PERKINS.

The accompanying illustrations show the construction and operation of a novel cylinder snow plow designed and constructed in the Province of Ontario. When the plow of this remarkable machine is forced into a drift or cut, the snow is lifted by the shovel, which is inclined upward and meets the expeller chambers, the snow gliding along until it comes in contact with the expellers the blades of which revolve at a high speed in an upward direction. Engaging the snow the blades throw it upward and outward at a great velocity, delivering it to a distance of 50 or 60 feet on each side of the plow and making a clear cut, 11 feet in width and at a speed of 6 to 8 miles per hour in a cut 10 feet deep. The snow is elevated and thrown at so great a distance from the track the possibility of the smallest quantity ever getting into the cut again is precluded. The snow does not enter the expeller chambers, and it is stated that the maximum velocity of the expeller blade at the periphery is 5 654 feet.

The accompanying illustrations are front and side views of this remarkable cylinder snow plow. In one view the snow expellers are shown in operation, in another a cut 12 feet deep is illustrated. The reader will doubtless note the impression which wedge and apron leave on the snow. The thin end projects only 20 inches ahead of the expeller.

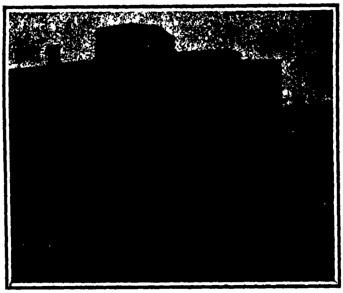
Other illustrations show the cleaned track in a ten foot cut, and the machinery within the plow car, including the boiler steam pipes and engine. The expellers are directly connected with the engine shaft by means of two steel chain belts.

It is stated that each of the steel chain belts driven by the steam engine of this plow is capable of driving the expellers at a moderate speed alone, so that should one belt be disabled the plow would still be able to work at a somewhat lower rate of speed.

The plow body is of steel construction throughout, the box portion having the sides covered with wood like a box car. The roof is of similar construction, which is fire and water proof. A door is provided on each side in the middle of the car, the back end being left open for convenience in stoking the boiler. A lookout is built at the front end of the car from which point the engineers can be signalled to.

The front end of the car, entirely of steel, has three chambers, the two side ones being circular, open at the front and one side, in which the expellers revolve. These are nine feet in diameter and three feet six inches wide. Each expeller consists of a cast iron hub upon which are formed four spiral flanges, having a pitch of about fourteen feet. Riveted to these flanges are four half inch steel plates or blades twenty two inches wide comprising a true helix upon the hub. The expellers are mounted upon each end of the shaft and overhang the pedestals the shaft extending into the circular chambers. On the middle of the shaft, which is eight inches in diameter, is keyed the sprocket wheel, which is connected with a similar wheel on the shaft of the engine by the steel chains. These four parts constitute the drive gear. The middle chamber opens to the interior of the car. On the front is constructed the nose of the plow, consisting of steel plates projecting forward to the end of the apron or shovel. It may be stated that the apron or shovel is attached to the bottom framing, the side plates, the interior web plates, and the expeller chambers, by steel angles and plates. This apron extends forward five feet beyond the center of the expellers. The nose and shovel, being firmly riveted together, present a rigid construction to engage the snow.

This powerful cylindrical snow plow has engines specially constructed. The cylinders are sixteen inches diameter with eighteen inch stroke and work under a steam pressure of 150 pounds per square inch, the maximum speed being two hundred revolutions per minute. They are capable of developing 750 I. H. P. and are placed as near as possible to the expellers to shorten the drive chain. The engines exhaust into the bottom of the smoke box of the boiler through a suitable nozzle similar to locomotive practice, creating a strong blast.



A view showing an expeller.

Hardening of Soft Stone.

Mr. A. Kubelka of Bushowitz in Morairu has discovered a process by means of which the softest sandstone or limestone can be made hard. The process is the following. First, the surface of the stone must be thoroughly cleaned, so as to expose the pores. Any oil or grease spots must be removed with benzine or with the alcohol flame. Missing pieces must be filled up with cement mortar, using a 1 7 solution of waterglass for tempering. After the stone is thoroughly dry, it is saturated with a solution of potash or soda waterglass. In case of rain during or immediately after this operation, the stone must be again cleaned, dried, and saturated with the solution. Then follows an impregnation with molten chloride of calcium. After this impregnation rain will do no more harm, as on account of the reaction of the chloride of calcium upon the solution of waterglass, the pores of the stone will be filled with insoluble, hard silicate of lime, while the soluble silicate of lime will be decomposed and washed out by rain. Another method of Kubelka's is to saturate the stone first with a solution of sulphate of alumina, in water, and when dry with a solution of potash waterglass. Sometimes a repetition of this process will be necessary to thoroughly fill all the pores of the stone. It is enough if the stone is saturated to a depth of about ½ inch. Whitish brush marks may be cleaned either by rubbing with a piece of the same stone, or by refacing the stone, or by brushing with steel brushes. Should the solution not impregnate the stone quick enough, it must be diluted with more water. The solution should be entirely absorbed by the stone in about one minute. Whatever is left over on the surface after this time should be wiped away with a rag, as the crystals formed by the evaporation of the water would make a rubbing and cleaning of the stone necessary. A separate brush should be used for each solution, so that the reaction should begin in the pores of the stone. For larger surfaces atomizers or sprinklers may be used successfully.

Through these processes any soft limestone or sandstone may be made more compact and hard. Their porousness and imperviousness will equal that of the hardest stone. After treatment they may be polished and cut. The great advantages of the soft stones—cheapness of quarrying and cutting—remain, and they can receive afterward all the prominent qualities of the harder stones.

Mortar and concrete may also be hardened and compacted by these processes, so that they may be used with greater success in works calling for water-tightness, as water works, tanks, street pavements, sidewalks, artificial stone, cement blocks, etc.

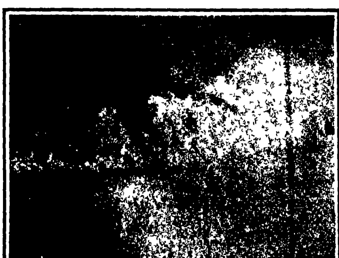
Monuments can also be protected by these processes from the influence of the weather.

Process of Removing Hair from Hides.

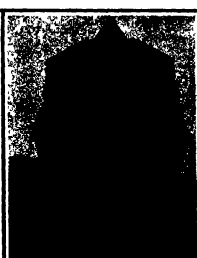
An article in the Ledertechnische Rundschau mentions, without describing in detail, a new process for the removal of hair from hides, in which the agents commonly employed for this purpose (lime, sodium sulphide, etc.) are replaced by "a suitable gas," which effects the removal of the hair in from two to eight hours. The process is said to be especially valuable for the preparation of colored leather and fine leather in general, as the product is of very uniform grain and free from the spots which are often produced by lime and sodium sulphide. The leather is also much closer, tougher, stronger, and more flexible than leather made by the usual methods. Hides treated by the new process may be tanned with bark, extract, or chrome alum. The inventor, whose address may be obtained from the journal quoted, will furnish detailed information to persons interested.

The Coming Aeronautic Show at Boston.

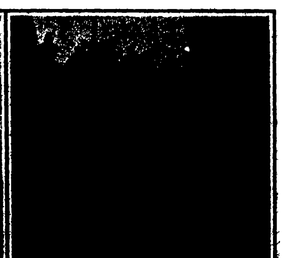
The first Aeronautic Show to be held in the United States without connection with any other exhibition, will open in Mechanics Building, Boston, Mass., on February 16th, and not on the 23rd, as announced in our last issue. This show will remain open one week. Seventeen full-sized aeroplanes have already been secured, and the exhibition promises to be a representative one as far as the heavier-than-air machines are concerned. The manager can be addressed at 5 Park Square, Boston, by any experimenters having machines to exhibit.



The plow in operation.

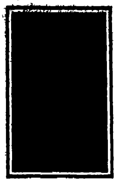


Front view of plow.



Plow withdrawn to show nature of cut.

CLEARING SNOW FROM RAILWAY TRACKS IN CANADA.



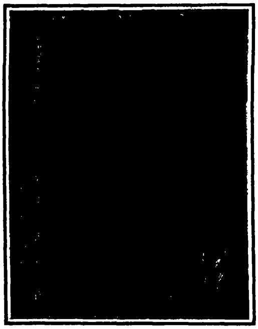
BERNARD PALISSY, THE FAMOUS FRENCH POTTER, AND HIS WORKS

BY CHARLES A. BRASSLER

Bernard Palissy, whose statue by Barrias appropriately graces the court yard of the Ceramic Museum at Sèvres, is one of the most interesting figures in history.

Born about 1510, near Agen, now in the department of Lot and Garonne, France, he was apprenticed early in life to a potter, and interested himself greatly in the technique of his calling, particularly in the possibilities of the various materials. He traveled in France and Germany, keeping this object in view and studying, for this purpose, geology and natural history, supporting himself in the meantime by working as a land surveyor. About 1539, however, he settled at Saintes and here, while engaged in his calling, he began his systematic researches into the manufacture of pottery and the composition of enamels. It was here, he says in his book, "L'Art de la terre," "that without considering that I had no knowledge of argillaceous earths, I began my researches into enamels, like one who gropes in the dark."

An enameled cup of faience which came into his hands inspired him with the determination to discover a method of producing white enamel, and for nearly sixteen years, neglecting almost everything else, he devoted his time and attention to investigations and experiments in this direction. During this period, doubtless, he made the discoveries as to colorings, glazes, etc., that laid the foundation for his future success. His first attempts were unsuccessful, but he pursued his researches with unparalleled persistence and energy, sacrificing everything to what was then considered more or less of a chimera, and to what brought him no profit. He exhausted all his resources, and lacking fuel for the firing of his kilns, was reduced to the necessity of burning piece by piece his household furniture. Ridiculed by his neighbors, bitterly reproached by his wife and tormented by the cries of his hungry children, he nevertheless persevered until finally, when reduced to the last desperate extremities, success rewarded his efforts.



Portrait of Palissy. From an old French miniature on vellum at Cluny.

Unlike most of the investigators and experimentalists of his time, Palissy had conducted his labors systematically, and when he attained his object, he was able to repeat his work and obtain the same results. A few vessels, ornamented with life-like representations of reptiles, insects and small animals and colored true to nature, were a revelation to the ceramists of those times and brought prices that soon enabled him to forget the hardships through which he had fought his way to success. He continued and perfected his researches and soon became famous, winning favor with the nobility and royalty, in the embellishment of whose palaces his genius was chiefly employed. This friendship stood him in good stead at the time of the massacre of St. Bartholomew, when the powerful protection of Queen Catherine and Anne de Montmorency, wife of the constable, saved him from the fate that befell so many of his fellow Huguenots, for Palissy had embraced the reformed faith.

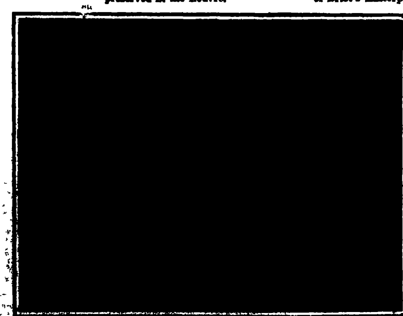
A man of studious habits and keen intelligence Palissy was among the earliest of French scientists to substitute for the fables and fanciful theories of so-called philosophers, hard facts, that were capable of practical demonstration. In 1575 he commenced the delivery of a course of lectures on natural history and physics, in which he gave a correct account of the origin of springs, the formation of stones and fossil shells, and advanced theories as to the best methods of purifying water, the use of marl as fer

(Continued on page 133)

A cup and pitcher made by Bernard Palissy and now preserved in the Louvre.

Palissy's reproduction in pottery of one of Briot's masterpieces. The Temperantia plate.

Pitcher belonging to the famous Temperantia basin and two candlesticks, all in the Louvre.



Large platter embellished with reptiles, fishes and shells made by Bernard Palissy.

"La Belle Jardiniere," a famous plate by Palissy preserved in the Cluny Museum.

BERNARD PALISSY, THE FAMOUS FRENCH POTTER, AND HIS WORKS.

THE HEAVENS IN FEBRUARY, 1910

BY HENRY NORRIS RUSSELL, PH D.

FIRST among the astronomical discoveries of 1910 is that of a brilliant comet reported from South Africa on the 17th of January

At that time it was but five degrees south of the sun, but it was so bright that it was visible in full daylight to the unaided eye, and observations of its spectrum, made next day at the Lick Observatory, showed the sodium lines bright on a continuous background- thus proving that the comet was very hot and self luminous.

This doubtless means that it was then very near the sun, and strongly heated by its radiation

From the scanty information which is yet available it appears that the comet is moving rapidly northeastward and diminishing in brightness. Its orbit has been computed and ephemeris will be found on page 123 of this issue It is probable that it will be visible for a few weeks in the evening sky, just after sunset, and almost directly above the point where the sun disappears. It is, however, quite possible that it may lose so much in brightness, as it retreats from the sun that it will not be very conspicuous On the other hand, it may be a fine object, and the evening skies will be well worth watching especially about the beginning of February when moonlight no longer drowns out faint objects.

Halley's comet is still visible in the evening sky and is very slowly increasing in brightness, but it will probably be too faint for the naked eye, though perhaps visible in a field glass.

It will fortunately be easy to locate Just north of the planet Saturn are three stars of the fourth magnitude, in an east and west line On February 5th the comet will be about 50 min of arc (or, roughly, one and a half times the moon's diameter) north of the middle one of these stars, and on the 17th it will be about the same distance north of the westernmost of the three By following this line of motion it can easily be found at any time

By the end of the month it will be pretty low in the west at sunset, and soon after it will vanish in the twilight, to reappear, much brighter, in the morning sky in April

While the appearance of these comets is exciting so much interest, a notable advance has been made in the explanation of these phenomena. Observations of the spectra of the last two bright comets (Daniel's and Morehouse's) showed that the light of the tail consisted almost entirely of bright bands, given out by some luminous gas. But at that time no gas was known which gave just these bands. Very recently Mr Fowler of South Kensington, England, has found that a vacuum tube, containing small quantities of nitrogen, and of carbon compounds (excited electrically so as to glow), shows a spectrum exactly like that of the comet's tails, provided the pressure of the gas is made exceedingly small

As the pressure and density of the gas in a comet's tail must be almost incalculably less than in any vacuum which we can produce by mechanical means, this gives us a satisfactory explanation of the observations The luminous particles though so thinly distributed through space, are molecules of familiar gases, and one of the mysteries which surround comets has been cleared away

THE HEAVENS

The splendid and familiar winter constellations are now seen in all their glory

Due south and about half way up the sky is Orion The very bright star below him to the left is Sirius. West of this, directly below Orion, are the small groups of the Hare and the Dove. Far below the latter, on the southern horizon, those who live south of Virginia or Missouri can see a star of exceptional brightness. This is Canopus, the principal star of the great constellation Argo, and, next to Sirius, the brightest in the heavens. This star's brightness might make us anticipate that, like Sirius, it might be a near neighbor of ours in space, but repeated and careful observations show that this is not so Its distance is too great to measure accurately, but it is at least ten times as far off as Sirius, and probably much farther from us. Canopus must therefore be really a most magnificent luminary, exceeding our sun at least a thousand fold in brightness.

To the left of Orion and Taurus are Canis Minor and Gemini, and right overhead is Auriga, with the bright star Capella. In the southwest there is nothing of much interest, but in the west we see two bright objects, one above the other, not marked on the map These are the planets, Mars and Saturn, whose motion among the stars makes it impossible to put them in our permanent maps of the heavens Mars is higher up than Saturn, and is redder in color

In the northwest we see Andromeda and Cassiopeia, and above them Perseus. This is another of the constellations which bears no real resemblance to anything in particular, but with the aid of the drawing in our initial it is possible to see how the ancients found here the figure of the hero carrying the head of the Gorgon Medusa, which is marked by the bright star Algol

The bright spot in the Milky Way, between Perseus and Cassiopeia, is a splendid star cluster, showing well in the smallest telescopes.

To see how the northern constellations appear in the sky, we must turn our map upside down, so that the words "Northern Horizon" are at the bottom. It will then appear that Cepheus is below the Pole, on the left. The Little Bear hangs by its tail from the Polestar. The Dragon is below, with his head out of sight and only his tail showing. The Great Bear is climbing up the heavens to the eastward, and is already high In the east is Leo, pretty well up, and above is Cancer, with the star cluster Praesepe. Farther to the right is Hydra—an immense constellation, whose head is already high while its tail will continue to drag itself into sight for three hours longer.

THE PLANETS

Mercury is morning star throughout the month, but is unfavorably placed south of the sun He may be best seen about the 20th, when he rises about 5·40 A. M

Venus is evening star until the 12th, when she passes between us and the sun and becomes a morning star. At the beginning of the month she is easily visible in the evening, setting more than an hour and a half later than the sun, and at its end she is similarly conspicuous in the morning skies.

During the middle of February she will be invisible to the naked eye, but as she passes almost 8 degrees north of the sun, she should be observable telescopically, in full daylight, as a thin crescent, all through this time.

Mars is evening star in Aries, remaining in sight till nearly midnight.

Jupiter is in Virgo, rising about 10 30 P M. at the beginning of the month, and 8 30 at its close.

Saturn is evening star in Pisces, setting about 10 P M in the middle of the month.

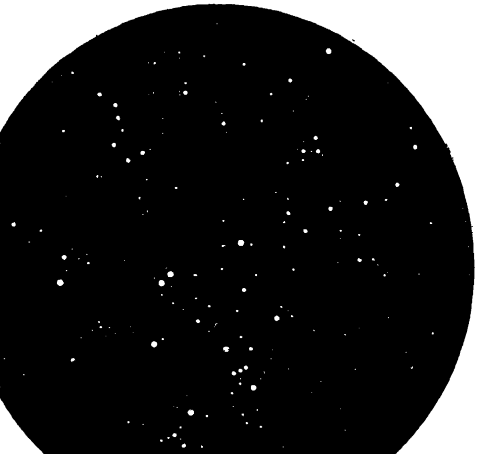
Uranus rises only about 1½ hours before the sun, and is unobservable.

Neptune is in Gemini, observable all the evening, but only with a good-sized telescope.

THE MOON

Last quarter occurs at 6 A. M on the 2nd, new moon at 8. P M on the 9th, first quarter at 10 P M on the 17th, and full moon at 8 P M on the 23rd. The moon is nearest us on the 12th, and farthest away on the 28th. She is in conjunction with Uranus and Mercury on the 7th Venus on the 9th, Saturn on the 13th, Mars on the 15th, Neptune on the 20th, and Jupiter on the 27th

Princeton University Observatory



At 11 o'clock: Jan. 7
At 10½ o'clock: Jan. 14.
At 10 o'clock: Jan. 22.

At 9 o'clock Feb. 6
At 8½ o'clock: Feb. 14
At 8 o'clock: Feb. 21.

At 9½ o'clock January 29.

NIGHT SKY: JANUARY AND FEBRUARY

The Library of the Assyrian King, Sardanapalus.

During the interval of the past fifty years twenty thousand stone tablets, approximately, of the library of the Assyrian king, Sardanapalus, were found in the course of excavations among the ruins of Nineveh and taken to London The texts written on them, which are related to one another apparently, are now published in their original cuneiform script by the British Museum in serial collections Various savants of the whole world have therefore an opportunity for further investigation of the texts of their special province, for every kind of text in cuneiform script presents its own particular difficulties to the translator and commentator In the fourteenth collection, or volume of the work are assembled those tablets of the king's library which regard chiefly the objects of the three natural kingdoms. Obviously many of these lists were prepared for purposes of medication.

For this reason a prominent physician, Baron Oefele, assisted by noted scholars in cuneiform script among them Prof Zimmern of Leipzig, began to examine this collection with a degree of zeal that has become quite prolific. Apart from the many lists which mention minerals, the numerous lists of animals are mostly of a uniform kind The names of animals are arranged in two columns, the same names being given in the first column in Sumerian and in the second column in Accadian, that is, in Babylonian Still far more interesting than the zoological lists are the botanical lists, of which there is a great number, and which give the most various directions to acquaint the aspiring physician with the effect and use of hundreds of medicinal plants. This fact may suffice to show that among the old Babylonians the knowledge of the natural sciences was already far greater than among their successors, the Greeks and Romans, whose names of animals and plants, it is manifest, have been derived partly from the Babylonian language.

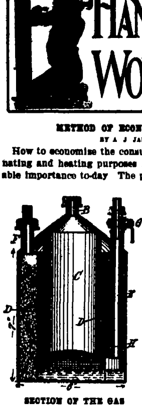
The shortest track for steamers from Panama to Yokohama, Shanghai, and Hongkong passes in close proximity to San Lucas Bay, near Cape San Lucas, at the southern end of Lower California, and to the ports of Manzanillo and Acapulco on the mainland of Mexico. Perhaps Manzanillo should be regarded as the closest port.

HANDY MAN'S WORKSHOP

METHOD OF ECONOMIZING GAS.

BY A. J. JARMAN

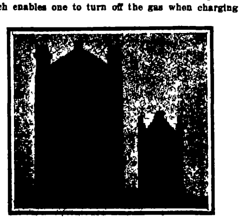
How to economize the consumption of gas for illuminating and heating purposes is a question of considerable importance to-day. The price charged for coal gas at the present time in many towns and cities is so high as to prevent its use for cooking purposes. Only by exercising the utmost economy in using only just enough to cook the small quantity of food required does the use of gas for cooking become advantageous under such conditions.



SECTION OF THE GAS ECONOMIZING APPARATUS.

By means of a simple apparatus the heating qualities of the gas can be improved so as to reduce cooking expenses and the cost of lighting as well, for in Welsbach and kindred lamps it is the heat of the burning gas that renders the mantle brilliantly incandescent. Moreover the lighting qualities of the gas are greatly improved as well. The following apparatus, which was first made by the writer in 1872, has been put to the test in hundreds of cases and has proved its efficiency in every instance. Any man who is handy in the use of metal working tools can make one and fit it to suit his gas supply by attaching it to the supply pipe after the gas has passed the meter, the gas then belongs to the consumer, it being the property of the gas company before it passes the meter.

The apparatus here described is suitable for a ten light meter, with all the fittings for lighting, heating and cooking. It consists of a closed tin cylinder *A* six inches in diameter and seven inches high without the conical top. Within this vessel is placed another cylinder made of galvanized wire netting, with a half inch mesh the diameter being four inches and height seven inches. This wire cylinder is placed within the tin case, having a one-inch space all round. Within this space clean, white cotton waste is packed. A tin cylinder *C* six and a half inches long and three and one-half inches diameter is soldered all round to the cone top of the cylinder *A* and is provided with a perforated bottom to allow the hydrocarbon with which the economizer is to be charged to run through and saturate the cotton waste *D*. The cylinder *C* acts as a spreader, causing the gas which enters by way of pipe *E* to contact in a thin layer with the cotton waste held by the galvanized wire cylinder and then pass out through pipe *F*. The apparatus is charged with benzine, gasoline, or a similar volatile hydrocarbon capable of being taken up by the nonilluminating constituents of coal gas, such as hydrogen, marsh gas or carbonic oxide. At *G* is a suitable brass stop-cock which enables one to turn off the gas when charging



A 100-LIGHT AND A 10-LIGHT GAS ECONOMIZER.

the apparatus with gasoline. The brass cap at *B* must have a disk of pliable leather fitted in the interior so that it becomes perfectly gas-tight when screwed down. It is necessary to make a hole in the supply pipe *E* at *H* so that in case the gasoline should cover the bottom of the inlet pipe this would prevent any flickering of the light due to bubbling of the gas through the liquid.

The charging of the apparatus must be carried out in daylight, and it should be fitted near a window where daylight is admitted, for a lighted match, candle or lamp must not be used. With these simple precautions the apparatus is perfectly safe. The cone top must be perfectly soldered where the tin cylinder meets, and all the brass connections attached to the inlet and outlet pipes must also be perfectly soldered. India rubber piping or connectors must not be used; soldered connections, metal piping and screened brass connectors alone must be used. When the economizer is fitted and charged with about three pints of gasoline it will be found that the intensity of light from an ordinary naked burner will be vastly improved.

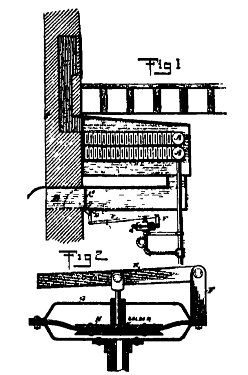
It has been found that half a gallon of benzine will take the place of 500 cubic feet for direct illumination in this apparatus.

The cotton waste in the economizer must be packed moderately tight. If packed too loose it will sink and give less surface for the gas to reach the gasoline. Be sure and mark the outer end of the inlet pipe *IN*. This will prevent any mistake when installing the device.

REGULATOR FOR INDIRECT AND DIRECT-INDIRECT STEAM HEATING

BY B. A. JOHNS

Every indirect and direct-indirect steam heater should have some kind of a regulator so as to shut off the air supply when there is no heat in the radiator, otherwise, especially at night when the steam pressure goes down and the air box remains open with the



REGULATOR FOR INDIRECT STEAM HEATING

cold wind blowing directly into it, it will soon cool off the house.

The accompanying illustrations show a very simple way to make such a regulator. Fig. 1 shows the general arrangement of an indirect heating radiator, and Fig. 2 shows in detail the regulator.

The radiator *A* is inclosed in a box in the usual way taking its air from the outside through the passage *B* and having a shutter or damper *C* mounted to turn in suitable bearings on a shaft. The latter has a small bell crank *D* secured to its outer end which through a link is connected to a lever *E*. The lever *E* is pivoted in suitable brackets *F* fastened to the regulator *G*. The regulator can be made of two small frying pans or skillets say about 6 inches in diameter. A part of the conical rim is bent outward forming flanges for bolting the same together. The bending is done very easily. Place the skillet over the edge of an iron block, and with a flat peen hammer stretch the edge, say about ⅝ inch all around. To the lower head, rivet a small floor flange, which will serve for connection with the steampipe from the boiler. In the center of the upper head a hole is made large enough to receive a half inch nipple. To the lever is fastened a short rod which passes down through this nipple to the diaphragm *H*.

The diaphragm is made of sheet rubber, say 3/16 inch thick with one or more layers of duck in it. To the top and bottom disks of iron with beveled edges about ⅛ inch thick are riveted. To the upper disk is soldered a half inch nipple or piece of pipe, serving as a guide. The whole is now placed between the two heads of the regulator and bolted together very closely.

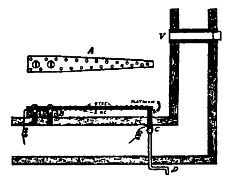
To the lower head is fastened the usual siphon pipe to prevent the steam from entering the regulator. As the steam pressure rises it will force the diaphragm upward, thereby opening the shutter *C* in the air passage *B*, permitting the cold air to pass under and through the bank of radiators, thereby heating them thence up through the register into the room and will keep it open until the steam pressure goes down. The weight of the arm *E* will then close the shutter permitting no more air to pass until again opened by the steam pressure. A weight may be attached to this lever, so as to close the shutter more effectually.

THERMOSTATIC ALARM FOR HOUSE HEATERS

BY F. F. ALLEN

The accompanying diagram shows how a simple alarm for house heaters can be made.

The object of this alarm is to give warning when the furnace is overheated and needs attention, or when the fire is nearly out and needs more coal. A thermostatic bar *A* 1½ inches by 1/16-inch is made of copper



THERMOSTATIC ALARM FOR HOUSE HEATERS

and iron riveted together very closely and fastened at one end are brackets *B* which are secured to a suitable base *H*. The free end of the bar *A* moves between two contact points *D* made of ordinary screw-eyes. These are screwed into posts *C* made of ½ inch dowel and secured to the base *H*.

The whole is fastened in an inverted position over the furnace or other place where there is danger of over heating. After the contact points are adjusted to close the circuit at the proper temperature they are connected up to an electric bell and battery as indicated in the drawing.

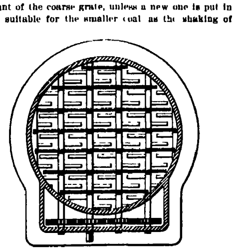
A switch is placed in the circuit at some convenient point. It will now be seen that when the thermostatic bar *B* moves to either side according to the temperature and makes connections with contact points *D* the bell *E* will ring. When the apparatus gives the necessary alarm the switch must be turned off until the trouble is remedied.

ADAPTING A GRATE FOR SMALL COAL.

BY J. A. SHEUSTROM

The grates in the ordinary house heating furnaces are regulated and made for the best and most suitable size of coal to be used in each particular case. That is to say in a large hot-air furnace where egg coal is most suitable, a very coarse and open grate is provided but in a smaller furnace where smaller coal is to be used, a much closer grate is furnished.

In some localities where pea coal is much cheaper than egg stove or nut it would perhaps be more economical to burn the pea coal provided the grate would permit. As a rule, if the pea coal is used in these large furnaces it has not proved very successful on account of the coarse grate, unless a new one is put in more suitable for the smaller coal as the shaking of



GRATE ADAPTED FOR BURNING SMALL COAL.

the old grate will cause the whole fire to dump into the ash pit.

To overcome this the writer has tried several methods and has come to the conclusion that the best is that shown in the accompanying illustration.

The grate is an ordinary rocking finger grate. Between every or every other finger (which will depend upon the kind of grate and also of the size of coal to

be used) is placed across the entire grate a piece of say ½ inch pipe or bar. These pipes or bars rest on the grate bars and are not affected by the rocking of the grate. As the ashes accumulate on top of these bars they have a tendency to keep them in place and will prevent them from moving or burning.

There should always be a layer of an inch or two of ashes on any grate. Care should be taken not to shake the grate too much, as a great deal of live coal will fall through and sometimes start to burn in the ash pit thereby warping and destroying the grate bars.

The writer has used some old pipes and grate bars for a number of years and to-day they are as good as new. Some years ago, during the coal famine, a great deal of bituminous coal was burned with perfect success. It is best when starting a new fire to clean out the ash pit and if any live coals fall through they may be shoveled up on the fire again until enough ashes are formed to prevent them from falling through.

HOW TO BURN COAL ECONOMICALLY

BY W. B. ALLEN

The accompanying illustrations show how in a very simple way the gases in an ordinary furnace may be consumed and burned thereby giving off a more uniform heat and maintaining an even temperature *throughout the house continuously night and day.* It will effect a saving on the coal bin and produce more heat besides.

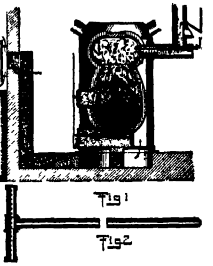
The fire in a stove or furnace is simply the result of a chemical union of the carbon properties of the fuel, both solid and gaseous, with the oxygen of the air.

By the complete combustion of one pound of coal 14,600 heat units are given off, but by the incomplete combustion of one pound of coal, as burned in the great majority of domestic heaters, only about 4,000 to 5,000 heat units are produced and the balance of the heat passes away up the chimney a rich combustible gas that should have burned.

To obtain the highest efficiency from coal it must be burned with the least possible supply of air consistent with perfect combustion, as an excess of air carries the heat of the fuel into the chimney and a certain mixture of air from below the grate will cause an explosion in the smoke pipe blowing the fire door open and filling the cellar with spent gases.

Nearly every furnace discharges so-called "coal gas" which is due either to poor draft or a defective furnace, or an improper adjustment of the dampers. As the odor is so noticeable, the difficulty is soon remedied. Every furnace, however, is constantly discharging more or less carbon monoxide gas which is perfectly odorless and is a very energetic poison, as the result of imperfect combustion.

Ordinarily the domestic user of coal roasts out the gas, opens the dampers and drives it up the chimney and then proceeds to burn the coke, which is only about one-half of the heat value of the coal, besides it is not alone the heat that escapes up the chimney, but the rich combustible gas that passes away unconsumed. This gas when burned produces a uniformly



ARRANGEMENT FOR BURNING THE GASES OF THE COAL.

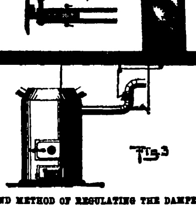
higher temperature than the coal itself, which may burn at varying temperatures even so low as to produce but little heat.

The clinkers that form in the furnace are the result of an excessive draft below the grate.

To accomplish the mixing of the hot gases and air the air must be heated to the same temperature.

The most common domestic heating furnace is the hot-air furnace. This is simply an improved stove inclosed in a sheet iron or brick casing. The furnace heats the air within this inclosure to a high temperature and therefore rises to the rooms above through tin pipes. To keep this current of hot air rising, a "cold-air box" connects the lower part of the furnace with the outside air and is regulated with a damper. This cold-air box should always be kept open as much as possible and never entirely closed while there is fire in the furnace, as the furnace will become overheated and may be injured.

Fig. 1 shows how the common hot-air furnace may be adapted to burn the gas of the coal. A small pipe, say 1 inch or 1¼ inch is inserted through the upper part of the smoke pipe (as the gases here are the hottest), terminating in close proximity to the smoke collar just inside of the radiator of the stove. The inner end may be fitted with a suitable spreader, such as shown in detail in Fig. 2. The cross pipes have a number of 3/16-inch holes drilled in the lower side, or



HAND METHOD OF REGULATING THE DAMPERS.

facing downward. The outer end of the pipe is fitted with some kind of a damper to regulate the supply of air. As the cold air passes through this pipe it becomes heated and at its delivery end is of the same temperature as the gases, but as the specific gravity of this heated air is much greater than that of the gases in the furnace, it drops down and mixes with the gases forming a combustible mixture which now burns with a blue flame, just as in an ordinary gas stove. If a small piece of mica is inserted into the fire door this burning may be observed. It is a very interesting phenomenon.

In order to make the system a success the fire pot must be in perfect condition, that is to say, in a hot air furnace there should be no communication between the fire pot and the air chamber, no cracks and no loose joints. The fire door should be as air-tight as possible. This may be made tight in the following manner. First, file and remove all rust at the edge of the door until a metallic surface appears, then cut a narrow strip of asbestos and soak in salt water, after which place it around the door and it will adhere. Put a litle oil on the door frame and close the door. The asbestos will then fill up any opening and bake very hard on the door.

If everything below the grate were absolutely air tight no combustion would take place, but as all furnaces leak more or less this leakage is enough to support combustion in ordinary weather. In extremely cold weather, however, the slide in the ash pit door may be opened a little, so as to furnish a little more air.

A damper is attached to the smoke pipe above the air pipe, so that when open it will not cool off the air pipe.

A fire is built in the furnace the ordinary way, keep the air damper closed until a good fire is obtained, then put on some coal and keep the lower damper open for a few minutes, after which close all drafts and open the air damper, regulate the same according to the heat required, that is to say, more heat, more air. Through the before-mentioned mica window observe the results. All the gases in the furnace will, however, not burn, as some are bound to escape unconsumed.

There is more economy in running a large, slow fire all day long than a hot one at intervals. Therefore it is best to coal the fire twice a day, in the morning and at night, and regulate it so that the fire burns with an even temperature. It will keep the house at a uniform temperature night and day.

When the furnace has been cooled for the day or the night the dampers may be controlled from any room above by simply raising or lowering a lever connected with wires running over pulleys to the various dampers, thereby saving many a step. This is shown in Fig. 3, a sectional plan of the levers is shown in Fig. 4.

In ordinary weather the fire should only be shaken once a day, preferably in the morning, but in very mild weather twice a week will suffice. Only shake until the first red coal comes down. In furnaces with very strong drafts shake but very little, as the layer of ashes on top of the grate will help check the draft. If the fire is very low stick a few pieces of kindling wood into the fire. This will heat up the smoke pipe. The ash-pit door may also be opened until the fire is drawn up, then regulate as before described.

With this arrangement in good working order every particle of coal will burn to an ash. The slate in the coal, of course, will not burn.

This applies to all three heating systems in domestic use, namely, hot air, hot water, and steam, as it only takes care of the fire.

In hot-air heating, in addition to regulating the fire, the cold-air box must be regulated. This box generally terminates outside the building under a porch. It has always been a source of annoyance because of changes in the direction of the wind. Sometimes the wind will blow directly into it and cool off the house, but when the wind is in another direction it will suck the hot air out from the furnace into the atmosphere. To overcome this a shield is placed in front of the box, say 8 inches from the building, overlapping about 12 to 18 inches all around. Then it will be impossible for the wind to interfere with the regulation of the air, which is generally done in the cellar with a damper or shutter.

The pipes in the cellar leading to the registers should be kept clean, also the registers. Avoid putting any wire netting to catch articles dropped thereon, as it will catch more dirt than anything else, sometimes clogging up the meshes completely, forming an excellent breeding place for bacteria.

The water pan should be connected with the water supply, controlled by a float valve. This insures an even water level in the furnace.

In steam heating plants the boiler and radiators should be large enough to keep the house at a temperature of 70 deg. in zero weather with one pound of steam, as this will take a great deal less coal than when the boiler and radiators are too small, and require a steam pressure of 10 to 20 pounds.

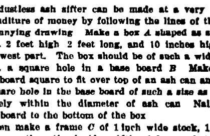
In houses where the draft is good one day and poor the next, despite favorable winds, the fault is with the chimney. It should be built higher. This is a great deal cheaper and better than to put an unsightly cap on it.

HOME-MADE ASH SIFTER.

BY J. A. BROPHY

A dustless ash sifter can be made at a very small expenditure of money by following the lines of the accompanying drawing. Make a box *A* shaped as shown about 2 feet high, 2 feet long, and 10 inches high at its lowest part. The box should be of such a width as to fit a square hole in a base board *B*. Make the base board square to fit over top of an ash can and cut a square hole in the base board of such a size as to be entirely within the diameter of ash can. Nail the base board to the bottom of the box.

Then make a frame *C* of 1 inch wide stock, 1 inch narrower than the inside width of box and 1 inch shorter than the inside length of the box. Bore a ¼-inch hole in the center of one end of this frame and cover the frame with ½-inch mesh galvanized netting. Inclose three sides of this frame with thin board about 5 inches high, tapering the two sides, as shown,



SECTIONAL VIEW OF THE HOME-MADE ASH SIFTER.

and leaving the discharge end open, which should be hinged to front end of box with two 2 by 3-inch hinges. Put a piece of rope through a hole in the upper end of frame and fasten it on top so that it will not pull out.

The box is now ready for the top which has a hinged door *D*, as shown. On top of box place a pulley and run the rope through the hole in the top of the box and over the pulley wheel. The end of the rope may have a large ring attached to it as shown.

This arrangement will allow the sifting frame to be swung up and down, jarring the frame every time it strikes the block *I* fastened to rear of the box.

Over the opening in front of box fasten a bag-shaped cloth to guide the clinkers to a suitable receptacle and prevent dust from rising.

This sifter has proved very clean and does not require a second shoveling of sifted ashes.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

BUTTON.—N Twamy, Hillsboro, N D This invention refers particularly to means of attaching buttons to garments and the like The object is to produce a button having a resilient or extensible shank of improved construction, which will yield or give under strain so as to relieve the strain to which the attaching stitches or cord is subjected.

Electrical Devices.

SPARKING DEVICE.—I W Gilbs, New Bedford, and C W Torby, Fairhaven, Mass. An object of this improvement is to provide a circuit breaker on an induction coil which will give one large spark instead of a succession of sparks, such as those produced by the ordinary form of vibrator Means are provided by which the core of the coil may be thoroughly magnetized before the break occurs.

Of Interest to Farmers.

COVERED BARN DOOR TRACK AND HANGER —E F Mohnike, Coggon, Iowa The principal objects which the present invention has in view are: to provide a device for hanging sliding doors, which is fully protected from rain and snow, and to provide a device which is simplified in construction and arranged to permit the installation thereof by an unskilled person

HAY LOADER.—J A Johnson, Wasco, Ill The mechanism carries the hay from the ground to an elevated point and deposits it into a suitable vehicle The elevation of the material handled is conducted so that the tailings are not carried over and deposited between the vehicle being loaded and the loader

BEATER FOR THRESHING MACHINES — J F Hixon Strawberry Point and O Fuller, Osborne, Iowa In the present patent the object in view is the provision of a beater frame, simple in construction while efficient for the purpose and which may be easily removed and replaced, and whose stroke may be adjusted in length independently of the other frames in the series.

Of General Interest.

PICKPOCKET DETECTOR. M. Wald, New York, N Y This invention relates to an improvement in garments, and particularly to a new and improved pocket, which is formed with a deep true pocket, and a shallow false pocket and detecting the intrusion of a pickpocket's hand therein. The pocket may be attached to any part of any garment

DREDGING SLEEVE.—W P Sudd, Oakland, Cal The object of the invention is to produce a sleeve having a protecting wall or coat of mail extending continuously around the axis of the sleeve and protecting it against injury from sand, gravel and small rocks, but at the same time permitting perfect freedom in flexing or doubling the tube

BASKET HOLDER —G S. Paine and A. D Paine, Winslow Maine The purpose of the invention is to provide novel features of construction for a basket holder, particularly adapted for the reliable holding of a plurality of berry baskets or other small fruit baskets at the front of the gatherer, so that berries may be conveniently removed from the plants or bushes and deposited in the baskets, both hands of a person being free for the gathering operation When the baskets are filled with berries, they may be removed by sliding them from engagement, and empty baskets may be placed in position

HYDRAULIC AIR COMPRESSOR.—J W Neal, Kelia Hawaii The invention provides a new hydraulic air compressor, arranged to utilize the force of the pumped water to compress the air isothermally in a very simple and efficient manner It relates to compressors more especially designed for use with wave motors, such, for instance, as shown and described in Letters Patent of the U S., twice formerly granted to Mr Neal.

COFFER DAM FOR PLACER MINING AND PIER BUILDING.—L. F Gilman, Spokane, Wash The object here is to provide details of construction for a coffer dam, which is adapted for erection at a selected point in a stream of water, and incloses an area of the bottom thereof, any suitable means for the removal of water from the dam being employed, to permit an excavation to be made in the soil thus exposed.

BARBER'S CHAIR.—A Fiore, Trenton, N J The seat in this chair is both revoluble and movable forwardly and rearwardly, and means are provided for positively locking the seat in successive positions against turning and means for locking the seat against forward and rearward movement, with a unitary device, such as a crank, for operating both of the locking means.

MEAT-HANGER.—J Fowler, New York, N Y. The improvement has in view a hanger in the nature of a clasp, which is adapted to be easily applied to and detached from a side of bacon or other similarly shaped piece of meat, and operative to firmly press on the meat at each side and give it the desired shape.

SIPHON —W. P Christopher and C De Lukacsevics, New York, N. Y This siphon is for use in dispensing beverages and some medicines. The bottle being filled with a liquid for instance carbonated water, the operator may discharge the contents of the bottle by merely pressing upon a knob. When the pressure is relaxed the bottle is closed automatically

POST FORMING MOLD —W W Bailey, Chadwick, Ill This invention consists of a post forming device or mold which will permit of a post being formed in a somewhat wet condition, and one in which the act of removal of the side walls of the mold will cause a troweling action and produce a smooth finish to the sides of the finished post.

Hardware and Tools.

DOOR-LOCK —C B Wallin, New York, N Y In this patent the object of the invention is the provision of a new and improved door lock arranged to lock the main bolt against movement unless first unlocked by the key, to prevent withdrawal of the latter and duplication thereof by unauthorized persons.

BACK BAND HOOK AND CLAMP —J P Freeman, Social Circle, Ga. Among the principal objects which the present invention has in view are to provide a clamping device to take up or to splice a flexible member of harness for attachment of the same to a chain and to provide an implement of this character which is simple, economical and durable.

COMBINATION TOOL FOR MINERS' USE A V Des Moineaux Denver Colo The purpose in this instance is to combine and arrange in a novel manner a plurality of implements that are necessary for preparing explosive blasts, wherein dynamite in stick form is the explosive agent that is to be fired by electricity or other means.

RAZOR STROP —R E Brown, Tidioute, Pa A means is employed to connect the strop with the swiveled suspending eye or device avoiding the usual bolt and nut arrangement generally objectionable for the reason that it wastes substantial length of the strop is bad in appearance scrapes and scratches wherever it contacts and is unsatisfactory in packing several strops together in a box

Heating and Lighting.

GAS-BURNER.—H C Farris Monongah W Va Among the principal objects which the present invention has in view are the provision of an apparatus wherein air, steam and gas are mixed and burned and the provision of an apparatus wherein the quantity of gas being mixed with the other ingredients may be regulated

Household Utilities.

WINDOW CLEANER —M Ax, Red Bank, N J One object of this inventor is to provide an improved means for detachably securing a wiper-strip upon a window cleaner A further object is to provide an improved form of tank and fabric-supporting means, whereby a fabric may be removably attached to the tank

REMOVABLE BROOM-PROTECTOR —Bertha Clark New York, N Y In this case the object of the invention is to provide a device which can be attached to the head of a broom and which will operate as a protector for the broom straws so as to reinforce them. In this way the device has a tendency to increase the utility and durability of the broom to which it is attached

RECEPTACLE LIFTER —J E. Wenman New Philadelphia Ohio. This lifter can be removably associated with cooking utensils or other receptacles of different kinds and sizes to permit their manipulation, which can be locked or clamped in position at the rim of a receptacle, by a simple manipulation which requires the use of but one hand, and which does not interfere with the use of a lid or cover upon the receptacle and can, in fact, be used to hold the cover in place

CLOSET FITTING —W M Weatherly Greensboro, N C In the present patent the invention has for its object amongst others to provide a construction which will permit the closet to be used, when necessary, when roughed for standard fixtures and will also take standard closets with gasket arrangements.

PERCOLATOR.—B N Young Ottumwa Iowa The object is to provide in this invention a device which may be cheaply constructed, and which may be applied to existing coffee pots without any change therein The percolator is adapted for making postum and similar beverages There is no possibility of burning the beverages, since they are elevated above the bottom of the vessel

Machines and Mechanical Devices.

TENSION DEVICE FOR WIRE SAWS J M Owens Oolitic Ind This device for wire saws of stone-sawing machines is arranged to permit convenient vertical and horizontal adjustment of the sheave, over which passes the endless wire saw to give the latter the necessary tension and to bring the saw into proper position according to the thickness of the slab to be cut from the stone block. The invention relates to stone-sawing machines such as shown and described in the Letters Patent of the U S., formerly granted to Mr Owens.

ROTARY PRESS.—J A Dowd, Fall River, Mass. There is provision in this invention for a device which will compress material efficiently and rapidly, and draw off the liquid exuded from the material, in a convenient and thorough manner It relates to a rotary press that forces the material to pass through a constricted neck, squeezing out the last particles of moisture

SPRING POST FOR WOODWORKING MACHINERY —C T Cummins, Long Branch, N J The object of this inventor is attained by providing a manually-controlled gearing for turning the post and locking it in the desired turned position by making the post vertically adjustable and providing means for locking it to the gearing and by providing a locking device for adjustably locking the spring finger to the post.

Prime Movers and Their Accessories.

VAPORIZER HEATING DEVICE —A P Osborn, New York, N Y This invention provides a means by which the headlight or other lantern of the automobile may be utilized to heat the vaporizer, so that when starting the machine it is only necessary to light the lamp which will furnish the heat necessary for starting the operation of the vaporizer and if desired this heat may be continued throughout the entire operation of the machine

STARTING EXPLOSION ENGINES —J R. Malivert, 92 Rue Pergolèse Paris France The method in this invention effects the starting of the engine by admission to the cylinder of a charge of compressed air upon the stroke in which the explosion would be normally taking place and is characterized by the arrangement of a diaphragm valve for each cylinder for admitting compressed air from a receiver the operation of these valves at the correct moment for each cylinder being determined by a distributer in constant relation with the engine shaft normally maintaining upon the diaphragms a pressure of compressed air which balances the diaphragm and keeps the valve closed and releasing this balance pressure when the compressed air is to be admitted to the cylinder

GAS AND STEAM POWER-GENERATOR — E. F Lamson Salt Lake City Utah The purpose here is to transpose the heat units of gas fuel into a mixture of steam and combustion gases suited in pressure and mass and temperature to supersede steam in operating those types of engine and by thus linking them to gas producing apparatus to embody a gas and steam power system which will retain the advantages of the steam engines and combine with them the thermal efficiency of the explosive gas engine

Railways and Their Accessories.

SAFETY ATTACHMENT FOR CAR BRAKES —J B Wright Greensboro N C This invention pertains to apparatus for automatically operating the brakes of a railway train in case of accident to the trucks or from any other cause which tends to throw the trucks into an abnormal position The abnormal movement of the trucks in any direction will operate to set the brakes in an air brake system instantly and thereby stop the train

METALLIC RAILROAD TIE. A M Baird Topeka Kan The invention relates to ties such as shown and described in three Letters Patent of the U S formerly granted to Mr Baird The tie plate spans a channel plate thus giving the desired flexibility to the tie thereby permitting the latter to successfully withstand the heavy pounding incident to powerful high speed locomotives passing over rails held on the metallic tie

TIE JACK C Berkner Litchfield Minn This jack is especially designed for use in lifting railroad ties and supporting the same beneath a rail during the spiking of the rail to the tie The jack will enable one man instead of three as formerly to replace ties in their proper position on the railroad track spike and tamp them

Pertaining to Recreation.

GAME APPARATUS C I Renner, Pittsburg, Pa This game comprises a vessel for containing liquid a gate arranged transversely of the vessel and provided with an opening and a plurality of buoyant figures in the vessel and adapted to pass through the opening It is entertaining not altogether a game of chance and may be played by any number of players

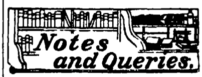
Pertaining to Vehicles.

SEAT SECURING DEVICE FOR WAGONS C W Harmes Mount Union Iowa This improvement provides novel details of construction for a seat securing device that may be readily connected with the body and seat of a wagon of the class of light freight wagons each provided with an oblong box like body having parallel sides and afford convenient and reliable means for detachably securing the seat transversely on the wagon body

CAR WHEEL AND AXLE. B L Worthen Tucson Ariz. Ter This invention relates to car wheels and axles for general use and more particularly for service upon small cars used in mines and adapted to turn sharp curves The wheels are provided with hubs and are loose upon the ends of the axle Each hub has a ring like enlarged portion which works in a recess in the framework the wheel being by this arrangement prevented from leaving the shaft The two wheels upon the same shaft thus turn independently Provision is also made for lubricating both the axle and the wheels.

SYSTEM OF BRACING FOR TRACTION ENGINES. W H Knorr, Tolstoy S D This invention relates to systems of bracing for traction engines, and is particularly useful in connection with such vehicle or other structures having spaced frame members supporting mechanism tending to distort the frame members, or adapted to be unequally loaded whereby the frame members are liable to distortion

Note —Copies of any of these patents will be furnished by Munn & Co for ten cents each Please state the name of the patentee title of the invention, and date of this paper



Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions books, etc This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 18th or will be sent by mail on request.

(12184) N C says I maintain that a person at North Cape Norway, on June 21st facing due north at midnight solar time will see the sun facing him. Supposing it possible for him to remain in such position twenty four hours, at 6 A M sun will be at his right at 12 M (noon) at his back, his shadow pointing due north at 6 P M at his left and at midnight again June 22d facing him as before The sun all the time is low in the heavens and in such position makes a complete circuit of the celestial sphere In a conversation with a friend who has been there that is to North Cape he says that facing the sun at midnight on or about date mentioned it would describe a comparatively small circle in the twenty four hours and would always shine in the face of the observer provided he maintained his position facing the north Will you kindly state which contention is the right one? A We will state the case of the midnight sun on June 21st as seen from the North Cape Norway On June 21st the sun is vertically over the Tropic of Cancer His declination changes but 22 seconds in that twenty four hours hence we may say that he is all day long threading the Tropic of Cancer He is therefore 23 deg 30 min north of the Equator and 66 deg 30 min from the North Pole all that day of twenty four hours. The latitude of the North Cape is 71 deg. 10 min 40 sec N Leaving the seconds out of the account as also the effect of refraction for the present, we may say that the North Pole is 70 deg 10 min above the north point of the horizon of the North Cape, and the sun is 66 deg 30 min from the North Pole toward the north point of the horizon at midnight The difference is 4 deg 40 min which is about nine diameters of the sun At midnight on June 21st from the North Cape if you look to the north if it is clear you will see the sun about ten of his diameters above the horizon since refraction will raise it apparently about a diameter After midnight the sun swings on up toward the east and keeps on a circle 66 deg 30 min from the North Pole as it goes At noon then it will be to the south of the North Pole by the same distance and it will be above the north points of the horizon by a distance equal to the sum of 71 deg 10 min and 66 deg 30 min or 137 deg 40 min This is 47 deg 40 min south of the zenith, or about half way from the zenith to the south point of the horizon The writer of this has been to the North Cape and is describing what he has seen The sun on June 21st does not describe a small circle about a point near the horizon as seen from the North Cape It moves around the North Pole as it does on all other days of every year changing in its declination somewhat each day so that in the winter half of the year of the northern hemisphere the sun is south of the equator and in the summer half of the year it is north of the equator but all the time the axis of the earth controls its apparent daily motion as seen from the earth You are correct as to the motion of the sun over the sky to the east south and west during the day but wrong in thinking that it will be low toward the horizon all day long as we have shown above Your friend is wrong in saying that the sun will describe a small circle The circle is 6 deg 30 min radius It is the smallest one which the sun describes but all stars nearer the pole than 66 deg 30 min describe smaller circles than that since all stars describe circles around the poles The pole star describes a circle of 1 deg 10 min 45 sec radius.

(12185) C F H says As I understand it, the earth's hour circles are 15 deg apart and a degree is equal to 60 geographical miles. Now if the distance between each circle is 15 degrees and as the hour circles converge toward the poles, the mileage or the number of degrees for each hour must vary Which is it, and how is the mileage of each parallel figured? A Your difficulty about the degrees and the miles of longitude arises from not remembering that a geographical mile is one-sixtieth of a degree of the earth's equator

and not a sixtieth of a degree of longitude taken in any latitude one may please. A degree of longitude varies in length from the equator where it is 60 miles long, to the pole where it has no length. An hour is 15 degrees of longitude in every part of the earth but not 900 miles. It is 15 times the number of miles the degree of longitude has in that latitude. The number of miles in a degree varies and not the number of degrees in a circle. There are always 360 deg in any circle and always 24 hours in any circle of longitude, hence there are always 15 deg in an hour even close to the pole itself.

(12186) P H T says: May I trespass upon your kindness to the extent of asking for a little scientific information regarding the horse power of ocean surf waves? What I would like to know is: If the surf waves are 3 feet high traveling 15 feet per second and arriving seven to the minute and it were possible to intercept an area 40 feet wide by 10 feet deep, say 400 square feet, and entirely absorb the energy, what do you figure would be the total horse power delivered by the seven waves, the interception being just outside the breaking line? Haswell gives some data under the head of "Waves of the Sea," but does not, I think, give any formula for ascertaining the horse power. A. It is not quite clear from your question whether the 400 square feet area is intended to be in the vertical or the horizontal plane. In the former case no power would be generated, as the movement of the water in waves before they break is only in the vertical direction, a wave consisting only of upward and downward motion of a successive series of vertical sections of the water; in the latter case it cannot be calculated what proportion of the area rests at one time upon one wave. In the transactions of the American Society of Mechanical Engineers, vol xiii, p 428, Albert W. Stahl, U. S. N., gives the formula for the energy E of the whole wave length of a wave H feet high, L feet long and 1 foot in breadth, the length being the distance between successive crests and the height the vertical distance between crest and trough:

$$E = 8\,L\,H^2\left(1 - 4.935\,\frac{H^2}{L^2}\right) \text{ foot pounds}$$

If N is the number of such waves per minute the horse power of a series of such waves per foot of breadth is

$$\frac{E \times N}{33{,}000} = 0.023\,H^2 L\left(1 - 4.935\,\frac{H^2}{L^2}\right)$$

(12187) M P V says: If I am not asking too much I would be pleased if you can help me out of trouble. I have a hot water heating plant in the house which has twenty radiators. Seventeen radiators work O. K. but the other three will not. I have written to the makers but they could not tell me the cause of the trouble. The three that cause trouble are at the end of the pipe and branch from a cross, the cross is 1 inch, radiators pipe ¾ inch, the main is 1¼ inch and reduced at the cross. Two pipes from the cross go to radiators on the first floor and the third pipe goes to the second floor. These three radiators return to a cross on the end of the return main. The pipes to the radiators on the first floor have a slight rise and the one to the second floor is vertical. There are no air traps, and I have had the pipes changed three times but with the same result. The expansion tank is placed on the radiator pipe before the end where the cross is placed. 1. Does it make any difference where the expansion tank is connected to system? A. The position of the expansion tank should not theoretically make any difference in the operation of the system, but we think in your case that it would be better to place it beyond, i. e., farther away from the boiler than the crosses to which the last three radiators are connected. 2. Should the end of the two mains be connected with a pipe other than through the radiator? All the radiators work from where the expansion is connected back to the furnace work O. K., but the three beyond this point will not work. A. There is no advantage to be gained by connecting the outflow of the return pipe otherwise than through the radiators. Such an arrangement, while probably increasing the average heat of the water in the pipes, would reduce the circulation of hot water through the radiators. The trouble is probably due merely to the three radiators in question being the most remote from the boiler, possibly also the expansion tank acts as a kind of hot water storage reservoir and radiates a good deal of heat itself, so that the radiators farther on receive colder water than those between it and the boiler. We would suggest putting the tank on the return from the farthest radiator to the cross or on the return pipe from the cross to the boiler.

(12188) C A J says: Take a standard ¾ inch pipe nipple. Lock it in a pipe vise 1 inches from one end. Screw on an extra heavy socket coupling 1½ inch outside diameter with a 12 inch wrench as far as the socket will go. Question: If a man weighing 170 pounds bears his whole weight on the handle of the wrench, what is the twisting strain exerted on the ¾ inch nipple? A. If a weight P acts at a distance a from the center of a shaft (or pipe) so as to twist it, the moment of the applied force is Pa. For your case the introduction of the thick coupling makes no theoretical difference, although in practice you get a better grip on account of the limitations of the tool. The force tending to twist the pipe acting on the fibers most remote from the axis of the pipe is to the force applied at the end of the wrench inversely as the distance of those fibers from the axis is to the length of the tool according to the law of levers. For example, if the weight of 170 pounds is applied 12 inches from the center of the pipe and the remotest fibers are 5/16 inch from the center, $P = 170 \times 12 \div 5/16$, $P = 6528$ pounds.

The twisting strain required to break the pipe calculated by the formula

$$Pa = 0.1963\,\frac{d^4 - d_1^4}{d}\,S,$$

in which P equals the weight acting at a distance a from the center of the shaft or pipe, d equals the external and d_1 equals the internal diameter of the pipe, and S equals the unit shearing resistance of the material of the pipe. The latter may be taken as the same as the direct shearing resistance, say 45,000 pounds for wrought iron.

(12189) C B. F says: 1. Selective radiation, as I understand it, seems in defiance of the law that all bodies emit the same intensity of light at the same temperature. Kindly explain selective radiation. A. The fact is incontrovertible that bodies exert absorption of light and heat selectively, and hence also radiate selectively. This being established it cannot be "in defiance" of any other law or fact. Laws do not thus defy each other in nature. Kirchoff showed that the emissive and absorbing powers of all bodies at the same temperature for a given color are proportional when the radiation is a pure temperature effect (Duff, "Physics," page 451, price $4). But there are many substances whose luminosity is not a pure temperature effect. Considerable space is given to this topic in Barker's "Physics," which we send for $3.75 postpaid. 2. Where can I secure information concerning the telectroscope (electrical vision apparatus) of the Andersen brothers of Denmark, notice of which recently appeared in the SCIENTIFIC AMERICAN? A. We have no other information concerning the telectroscope than is given in the reference which you make. 3. Where can I secure a complete account of Tesla's experiments with high tension currents? A. No complete account of Tesla's work with high potentials has been published. We can supply you with a small book with the title "Experiments at High Potentials," for $1, giving the principal part of the work.

(12190) J R asks: How does science explain the gyroscope phenomena? A. The gyroscope illustrates the persistency with which a rotating wheel resists any effort to twist its axle out of its position, or rather to turn the plane of the wheel out of its position. When the wheel is made very heavy and spun around very swiftly, it becomes very hard to turn it sidewise at all. Such a wheel is able to hold a car on a single rail from upsetting. This is the principle of the monorail car which has attracted so much attention recently. We published an illustrated description of this in three issues of the SCIENTIFIC AMERICAN, price 10 cents each mailed. We have published a number of articles regarding the theory of the motion of the gyroscope. You will find them in the SCIENTIFIC AMERICAN SUPPLEMENT Nos. 1644, 1645, 1643, price ten cents each. We can also supply the following books: "Elementary Treatise on the Theory of Spinning Tops and Gyroscopic Motion," by Crabtree, price $1.50; also "Rotary Motion as Applied to the Gyroscope," by Barnard, price 50 cents.

(12191) J M asks: Can you tell me at what rate light travels? A. Light travels with a velocity of 186,000 miles a second. This has been measured with a good degree of accuracy by both Michelson and Newcomb separately at Washington. For their determinations see our SUPPLEMENT Nos. 193 and 557, price ten cents each.

(12192) S N S says: If you have the information in memory or conveniently accessible, please tell me the cost or approximate cost per mile of any part of our subway railways and any part of any two track city trolley line, though I would rather have the approximate average cost of subways and trolleys (cost of line only, everything except rolling stock and power stations). A. It is very difficult to obtain exact figures for the cost of excavation of New York or other subway railways, and division of the total cost by the total length may make the cost per foot or mile very wide of the mark for any individual foot or even mile, on account of the great variation of ground and method. A general article on the New York subaqueous and subterranean railways in the April 1907 number of the Engineering Magazine gives a good idea of the reasons for this discrepancy, or you could obtain a list of articles covering the subject from the Engineering News. With the great variety of subjects we have to cover we cannot keep statistics of any one subject so closely. The cost of the Pennsylvania Railroad improvements from Newark to Long Island City, including hard rock tunneling under Manhattan with low first cost of equipment but expensive in time and labor, and shield tunneling in silt under the rivers, rapid and cheap in execution but expensive in first cost of plant, would work out at about $2,000 a foot for a two track subway. The included cost of the huge and costly terminal station is balanced by the comparatively low cost of several miles of embankment railroad only from Newark to Bergen Hill. The Brooklyn extension of the present subway, with smaller tunnel and no expensive stations but much the same variety of excavated ground, cost only about $300 a foot. Construction of ordinary city street railways would rarely approach a tenth of that figure. You will understand from the foregoing that these figures are the merest approximations.

(12193) R. W says: I wish to get a solution of a problem which has puzzled me for some time. I understand that a horsepower is a definite thing. I have a small automobile whose engine is rated at 20 horse-power. The cylinders are 3¾ inches diameter by 4 inches stroke. I also have a four-cylinder marine engine whose cylinder diameter is 4¾ inches diameter and 5½ inches. Now both of these engines are rated at 20 horsepower. Would you be kind enough to show me why there is such a difference in size? A. You are correct that a horse power represents a perfectly definite amount of work done in a given time, 550 foot pounds per second or 33,000 per minute. Gasoline engine rating is however rather more arbitrary than that of steam engines and not always so closely related to test figures. In either case the number of foot pounds of work done is the product of the piston speed by the mean effective pressure, and if your two engines have been accurately rated by their makers, and each gives approximately 20 brake horse-power, the only explanation is that the one with the larger diameter and stroke of cylinders must compress and also explode the gas to a lower pressure, or have a longer proportionate expansion, making the mean effective pressure less.

(12194) H M S says: On November 20th I observed a star about two points north of east and about ten degrees above the horizon. This star as I watched it became alternately a bright red and a pale yellow. Can you explain this? A. The star which you observed is Aldebaran of the Constellation Taurus. The changes which you observed in its light and color are entirely atmospheric effects due to the slightly different paths which the rays take through the atmosphere. These changes are greater at some times than at others. They are wholly in the air, and not in the light of the star at all. 2. At the same time I also saw a very large and brilliant white star (or planet) about two points west of N. W. by W., and between twenty five and thirty degrees above the horizon. Can you tell us what star it was? A. The bright object is the planet Venus, which is moving away from the sun to the east and so is our evening star in the western sky. Your estimate of its altitude is too large. Degrees near the horizon are deceptive, just as the apparent sizes of the sun and moon at rising are deceptive.

(12195) E. R says: In 1900 Dewar obtained a temperature of −260 deg C by evaporating liquid hydrogen. Has a lower temperature been obtained since, and how? Is it possible to obtain a temperature below −273 deg C? A. Much has been done since 1900 in the production of low temperatures. In 1908 the last remaining gas was liquefied by Kamerlingh Onnes of Leyden, Holland. Helium, under a pressure of 100 atmospheres, was cooled in a bath of boiling hydrogen to −258 deg C, the boiling point of hydrogen. Then it was still further cooled by the regenerative process, and liquefied. The boiling point of helium under atmospheric pressure is about −268.5 deg C. By boiling it under a pressure of one centimeter of mercury the temperature is lowered to −270 deg, or 3 deg above absolute zero. There is no substance known by which the cooling can be carried further, and there is little hope of reaching −273 deg., or absolute zero by any means within our power.

(12196) P T says: Will you be kind enough to answer for us the following: If, for instance, a bricklayer's plumb bob was suspended in a vacuum and kept perpendicular, moving through space on the surface of the earth at a uniform speed of say 60 miles per hour, would the plumb bob show a true perpendicular or would it be slightly out, and if so would this be noticeable to the naked eye? A. A plummet would not deviate from a perpendicular by being in a vacuum. Gravity acts in a vacuum just as it does in the air. Nor would it be affected by a velocity of 50 miles per hour in a vacuum. It is going very much faster than that at present by the motion of the earth through space, at the enormous velocity of 18 miles a second. It is also moving with a velocity of 1,000 miles per hour on the equator by the eastward rotation of the earth upon its axis, and more than three-quarters as fast as that in the latitude of New York. Balls fall somewhat to the east of the point from which they are dropped, but this is due to another cause, the fact that they go from a level of more rapid to one of less rapid rotation of the earth. See Young's "General Astronomy," which we send for $3 postpaid.

(12197) C J H says: A bets that the motorcycle has been driven to a higher speed than the automobile, and that the records show it. B bets that the automobile has been driven the faster. Who is right and what is the record? A. In reply to your query, the automobile has made faster time than the motorcycle. Marriott's mile on the Stanley steamer at Ormond Beach in 28 1/5 seconds (127.65 miles an hour) is, we believe, the record. G. H. Curtiss claimed he made a mile in 26 2/5 seconds on a 8-cylinder, 80 H. P. motorcycle of his own make at Ormond, but this was not official. The motorcycle record for a mile, 42 3/5 seconds, was made on a track by Fred Huyck.

(12198) A. W S. says: We have trouble with resonance or echo in our church, which is very annoying. The audience room is about 70 feet long, by 40 feet wide. The speaker's desk is in the center of one side, in front of organ and choir. We are considering the matter of stretching a wire the length of the church at some distance from the speaker and in front of him. Will you kindly tell us if a wire would at all relieve the situation? Would several wires be more likely to relieve the trouble? How far relatively from speaker toward opposite wall should a wire or wires be placed, and how high? A. The echo in your church will not be remedied by one wire, nor perhaps by a large number of wires run across the room. The belief formerly was that a set of fine wires so fine as to be nearly invisible, could be stretched across the room above the heads of the audience, perhaps ten feet from the floor, and that these would break up the sound waves. Hundreds of wires were thus used, ranging back through the room, at the same height, covering all the space. The best remedy for an echo is a full audience. Next, the hanging of loose curtains of soft materials on the walls. Prof. W. C. Sabine of Harvard University, Cambridge, Mass., has made many experiments in this matter. You will find an article upon his work in our SUPPLEMENT No. 1772, which we will send for ten cents.

(12199) W J W says: How cold would it be if it were twice as cold as zero? A great many answers have stated that it would be 230 deg. Fahrenheit below the Fahrenheit zero, working from the basis that absolute zero Fahrenheit is 460 deg. below the Fahrenheit zero. A. Absolute zero is the temperature at which all heat would be removed from a body, or the temperature at which molecular motion would cease. From the observed fact that all gases contract 1/273 of their volume by cooling from zero Centigrade to one degree below zero, it is inferred that absolute zero is −273 deg. Centigrade, or −459.4 deg. Fahr. This is to be found in all the larger textbooks of physics. The degrees from absolute zero express the relative quantity of heat. Degrees of a thermometer do not give any idea of the relative quantity of heat, but only of relative temperature. The correct answer, if there be one, to the question, How cold would it be if it were twice as cold as zero Fahrenheit? is that it would be 229.7 deg. below zero. For the theory of gases on which the absolute zero is based see Carhart's "University Physics," vol. ii, page 29, etc.

(12200) H. B says: Can you tell me whether a photograph has ever been sent by wireless telegraphy or whether it would be possible? A. We have never heard of sending a photograph by wireless telegraphy, and we are sure we do not know whether it is possible or not. He would be a rash man who would set the bound for the possible in this world of science.

(12201) A G asks: I have been trying to build a Wimshurst electrical machine as described in the SCIENTIFIC AMERICAN SUPPLEMENT No. 48, but I have never been able to procure the brass balls to tip the rods and tubes with, that is, solid brass ball. I can get plenty of hollow brass balls. Would there be any kind of composition or filling a person could fill in the hollow brass that would answer the purpose, just as well as the solid brass? A. It is not necessary that the brass balls of a Wimshurst machine should be solid. They will work just as well if hollow, but they are not as strong as if solid. You may fill them with anything to make them stiff and strong. Even a wooden ball covered with tin foil would serve the purpose, but to a less degree, since its surface would not be smooth. Only the surface of the metal on a static machine takes part in the electrical action of the machine.

(12202) W M asks: Can you supply me with a formula to meet the following case: It is desired to calculate the quantity of water delivered and height of jet from the nozzle of a fire hose when the following details are given, viz., head of pressure at fire engine or elevated tank, length and diameter of pipe, total fall, size of delivery nozzle. I have all the usual hydraulic formulas and tables giving flow of water in pipes and loss of head due to friction in pipe. From this latter cause (friction) it will be found that a moderately long pipe, say 1,000 feet, of moderate diameter, say 3 inches, having a head of 100 feet, will have all the head absorbed in friction, but in practice I actually get a moderately good fire stream through a 7/8-inch nozzle. It is understood that this result is obtained by the small orifice of nozzle delivering less quantity, and causing a reduced velocity of pipe, and therefore less loss of head, but I find no formula or rule whereby to work out the problem before described, viz., quantity delivered and height of jet. Books do not handle this special question. A. In further reply to your letter, the height of a jet of water thrown from a

fire-hose nozzle is calculated by the formula $h = KH$, in which h = the height of the jet in feet, H = the head of water in feet (or head corresponding to the pressure, 0.43 pounds to the square inch pressure = 1 foot head), and K = a coefficient varying with the ratio of the diameter of the jet to the head as follows

If $H = d \times 300$	600	1000	1500	
$K =$	0.96	0 9	0.85	0 7
If $H = d \times 1800$	2800	3500		
$K =$	0.6	0.5	0 25	

For the case you mention your 100 feet of head = H, and $d = 7/8$ inch, so $H = 1370 \times d$ and the coefficient $k = 0\ 74$ The theoretical height of the jet should therefore be $0\ 74 \times 100 = 74$ feet. The head H must be corrected, however, by the friction in pipe and hose The loss of pressure or its equivalent loss of head may be calculated by the formula $h = v^2 (4m) \frac{l}{2gd}$, in which the constants are d = 3 inches diameter of pipe (in your case) = 0.25 foot, l = length of pipe = 100 feet and $2g = 62\ 4$, and the variables are v = velocity of water in feet per second, h = loss of head per 100 feet of pipe, and m = a coefficient found by experiment. The velocity v must be calculated from the measured discharge of a given pipe, i e, the cubic feet of water discharged per second by the sectional area of the hose. The coefficient m varies from 0 0045 for a discharge of 200 gallons per minute or a velocity of 18.07 feet per second in a 2½ inch pipe to 0 00452 for 500 gallons per minute or 32.67 feet per second in a 2½ inch hose. A simpler but less closely approximate formula for loss of head is $h = \frac{lq^2}{1801 d^5}$, in which h is loss of head in feet as before, l = length of pipe in feet, q = quantity of water discharged in gallons per minute, and d = diameter of hose in inches. We regret that we cannot conclude the calculation for you as you do not mention the quantity discharged which prevents our arriving at the values of v and m in the second formula or q in the third but from your discussion of the subject we have no doubt that with the above particulars you will easily be able to calculate the height of the jet yourself

NEW BOOKS, ETC.

Elements of Machine Design By Dexter S. Kimball, A.B., and John H Barr, M S, M M E. New York John Wiley & Sons 1909 8vo., pp 446, 196 cuts. Price, $3

This work is the outgrowth of the experience of the authors in teaching machine design at Cornell University The first three chapters are introductory, taking up the fundamental principles of machine design, a brief discussion of energy and force problems, and the more important straining actions, with formulas for strength and stiffness. Chapter IV takes up lubrication and efficiency, while the remainder of the book deals with important machine details illustrating the application in practice of the theoretical considerations discussed in the first part of the book

Direct and Alternating Current Testing By Frederick Bedell, Ph D, assisted by Clarence D Pierce, Ph D New York D Van Nostrand Company, 1909 8vo, pp 265 Price, $2

This work has been prepared primarily for students, although it will doubtless be found helpful to others. It consists of a series of tests on direct and alternating current apparatus, which are explained in such a manner that the reader's attention is directed to the principles underlying the experiments and the significance of the results. Such tests as require special apparatus or unusual testing facilities are left out of the text proper, though they are described in the appendices to the various experiments.

Lessons in Telegraphy By Charles Henry Sewall. New York D Van Nostrand Company, 1909. 12mo., pp. 88. Price, $1

The book is intended as a textbook for schools and colleges and is intended to furnish the student not only with the ordinary instructions necessary to learn the art of telegraphy, but also takes up the negative side of the study, telling the student what not to do, and thereby preventing him from forming bad habits which might be difficult to remedy later on.

Radiation, Light, and Illumination Series of engineering lectures delivered by Charles Proteus Steinmetz, A.M., Ph.D., compiled and edited by Joseph Le Roy Hayden New York. McGraw-Hill Book Company, 1909. 8vo.; pp. 305; 127 cuts. Price, $3

These lectures by Professor Steinmetz before the students in electrical engineering at Union University have been compiled not only to provide a textbook of illuminating engineering, but also to provide the public at large with a knowledge of light and radiation. For this reason mathematics have been avoided in all the lectures except two, which by their nature are mathematical and are intended for the illuminating engineer. However, the general reader, who has little knowledge of mathematics may avoid these two chapters without serious

College Algebra By H L. Rietz, Ph.D, and A. R. Crathorne, Ph D. New York Henry Holt & Company, 1909 12mo, pp 261. Price, $1 40

Recognizing the fact that a considerable period of time elapses in most cases between the completion of the high school algebra and the beginning of college mathematics the authors have devoted the first part of the text book to a review of high school algebra At the same time new matter is introduced which his added maturity enables him to appreciate In treating the more advanced portion of the subject many topics usually found in textbooks and college textbooks are omitted and the matter is restricted to the development of those central points which the experience of the authors has shown to be essential.

Alternating Current Motors By A S McAllister, Ph D Third edition New York McGraw-Hill Book Company, 1909 Pp 322, 138 figures Price, $3

The present edition has been enlarged and revised, and takes up the recently developed "split pole" variable-ratio synchronous converter and contains a chapter on synchronous motors, in which the characteristics of this machine as a motor and as a "condenser" are fully treated The chapter on prevention of sparking in single-phase commutator motors includes the latest improvements in commutating pole motors.

Theoretical Elements of Electrical Engineering By Charles Proteus Steinmetz, A.M, Ph.D Third edition New York McGraw-Hill Book Company, 1909 Pp 455, 239 illustrations. Price, $4

The present work is in a certain respect supplementary to "Alternating Current Phenomena" and contains specific discussion of the different features of individual apparatus, presenting the most important electrical apparatus and their action under normal and abnormal conditions The first edition, which was published eight years ago, is now revised and much enlarged, so as to bring it up to date in theory and practice The author recommends that this book be read in parallel with the first seventeen chapters of "Theory and Calculation of Alternating Current Phenomena," as in this way a clear insight into the nature and behavior of the apparatus will be obtained

Dynamo Laboratory Manual for Colleges and Technical Schools Vol I Direct-Current Studies and Tests by William Suddards Franklin, with the co-operation of Stanley S Seyfert, and Clarence E Clewell New York The Macmillan Company, 1909 12mo, pp 152 Price, $1 75

The authors describe a series of laboratory experiments for students, many of which are chosen primarily for their educational value, while others are such as are sometimes carried out in practice The directions are very complete and practical, and the authors suggest that the students be thrown upon their own resources in performing the experimental work so that they will become accustomed to translating scientific writing into ideas of reality and also develop manual dexterity

Astronomy From a Dipper. By Elliot C Clarke. Boston and New York Houghton, Mifflin Company, 1909 Pp 66 Price 60 cents.

The object of this book is to acquaint the amateur with the positions of the constellations and the names of the principal stars. The Great Dipper is used as the spot from which the various constellations are pointed out, hence the odd title of the book. The subject is considered in a semi humorous vein and the object is well carried out by the author, who claims that because he knows but little more than his readers he is for this reason eminently fitted to be their teacher

Electric Railway Troubles and How to Find Them By Paul E. Lowe, M E. Chicago Frederick J Drake & Co, 1909 12mo, pp 267, 118 figures. Price, $1.50

This is a book for motormen and is designed to acquaint them with the mechanism of their cars and enable them to make their own repairs in emergencies. Their author aims to avoid complication and endeavors to explain everything in the simplest terms possible and in a thoroughly practical manner In order that the motorman may fix the matter in his memory, a "Repair Catechism" is included in the book, which contains 109 questions and answers.

Compressed Air. By Lucius I Wightman, E.E. Chicago American School of Correspondence, 1909 Large 8vo, pp. 168.

This is a reference work on the production, transmission, and application of compressed air; the selection, operation, and maintenance of compressed air machinery and the design of air power plants. Compressed air and electricity to-day share between them the great field of power transmission, to the practical exclusion of all other transmission agents Steam, because of its rapid condensation, can hardly be considered as a practical power transmitter for any but the shortest distances Hydraulic transmission has had no general application; Mechanical means of transmission, such as shafts, belts, ropes, chains, and gears, are necessarily very limited in their possibilities. Compressed air and electricity, on the contrary offer almost unlimited possibilities of extension and of diversified application, and in all cases, where properly applied, they are entirely successful when measured by the modern standards of commercial economy With the relative merits or shortcomings of compressed air and electricity as power transmitting agents the work has nothing to do Modern engineering has defined with reasonable clearness, the respective fields of these agents, into either of which the other agent cannot hope to enter with any degree of success. The rivalry of the earlier days between these two forms of power transmission has given place to a mutual recognition of one another's merits and cordial co operation in certain classes of work for which neither alone is fully adapted The illustrations are numerous.

Wood Products Distillates, and Extracts. By P Dumesny and J Snoir Translated from the French by Donald Green London Scott, Greenwood & Co, 1908 New York D Van Nostrand & Co 8vo, pp 320 Price, $4 50

The literature on wood products which are obtained by distillation and extraction is very limited, so that the present volume will be warmly welcome The work is divided into two parts, the first dealing with the chemical products of wood distillation and the second with dyeing and tanning extracts obtained from wood The chapters deal with the principal method of distilling wood, the acetic acid industry, the secondary products of wood distillation, the analysis of raw materials and finished products the extraction of extracts, etc, for tanning and other purposes. The work is well illustrated by appropriate engravings

The Problem of Evil A Criticism of the Augustinian Point of View By Marion Leroy Burton, B D, Ph.D Chicago The Open Court Publishing Company, 1909 12mo, 234 pp Price, $1 25

The readers of this book are warned at the outset that the work is not intended for the popular reader, but is a detailed technical criticism of the philosophical basis of the Augustinian treatment of the problem of evil The last chapter however summarizes the conclusions of the author and may be taken up with interest by those who do not care to delve into the arguments by which the author has arrived at his position A partial list of Augustine's own works and such other books as the author has found useful in preparing his criticism is given

The Apocryphal Acts of Paul, Peter, John, Andrew and Thomas By Bernard Pick Chicago The Open Court Publishing Company, 1909 12mo, 376 pp Price, $1 25

The present work is the first attempt to make the researches of Lipsius and Bonnet on the Apocryphal Acts of the Apostles and Schmidt's Coptic Acta Pauli accessible to the English reader Only the older and more important Acts are taken up in the present volume Although these Acts contain both truth and fiction, they are of importance as giving us a picture of Christianity toward the end of the second century and form an important contribution to the primitive literature of the Church. The text is accompanied by copious notes, particularly that part dealing with the Acts of Paul

Star Gazer's Hand Book A Brief Guide for Amateur Students of Astronomy By Henry W Elison, Ph D New York Sturgis & Walton Company, 1909 16mo., 55 pp, 4 plates Price, 50 cents.

The author, who has presented the subject of astronomy at teachers' institutes and similar gatherings, has compiled the present handbook at the special request of a number of teachers in a very condensed form and without the use of mathematics, the main astronomical facts are given The constellations are dealt with in particular with the mythological stories relating to them

Castles and Chateaux of Old Burgundy and Border Provinces By Francis Miltoun Boston L. C Page & Co., 1909 12mo, 333 pp Price, $3

The old Burgundian Province was closely allied topographically, climatically, and by ties of family with many of its neighboring political divisions, and it is for this reason that this section of France is of particular interest. Not in the royal domain of France itself, not in luxurious Touraine, were there more of splendor and the costly trappings of the ceremonial of the Middle Ages than in Burgundy, which has ever been a land of prosperity and plenty To the traveler in France this section of the country affords particular advantages access is easy, owing to good means of communication by a network of railroads. The author has presented the subject in a most interesting manner, and the illustrations by Blanche McManus are reproduced from paintings made upon the spot The book is handsomely printed and bound, and is most luxurious.

The Wonders of Asiatic Exploration By Archibald William, B A., F R G S Philadelphia J B Lippincott 1910 12mo; pp. 159 Price 75 cents

The titles of the chapters of this interesting book are as follows Four Years in the Wilds of Asia, Further Adventures in Eastern Turkestan and Tibet Surveying in Mid Asia; Lhasa Visited From Manchuria to the Pamirs An Adventurous Journey Among Celestials and Lamas The Strange People of the East Indian Archipelago The Unexplored Peaks of New Guinea The contents of this book have been taken from Mr Archibald Williams's larger book entitled "The Romance of Modern Exploration," and a chapter on Exploration in New Guinea by Mr Norman David son has been added The book is a very timely one giving the very latest information available

The Wonders of Animal Ingenuity By H Coupin D Sc, and John Lea M A. Philadelphia J B Lippincott Company, 1910 12mo, pp 163 Price, 75 cents.

This attractive book deals with some of the wonderful activities of the animal world The first chapter deals with "Master Craftsmen" the second and third chapters with "Excavators and Miners" then comes a chapter on "Makers of Baskets" then one on "Architects of Spherical Dwellings" then there comes a chapter on "Makers of Mounds Ants" This is followed by the "Mounds Made by Birds" then come two chapters on "Masons" An entirely new concept of the animal world is obtained by a perusal of this fascinating book which has an extremely ugly cover

Makers of Electricity By Brother Potamian, F S C, D Sc Lond., Professor of Physics in Manhattan College N Y and James J Walsh, M D, Ph D LL D, Dean and Professor of Nervous Diseases and of the History of Medicine at Fordham University School of Medicine, Professor of Physiological Psychology at the Cathedral College, New York New York Fordham University Press, 1909 pp 404

Dr James J Walsh who with Brother Potamian presents this new series of biographies, attracted not a little attention in literary and scientific circles with his "Makers of Modern Medicine" and "The Popes and Science" in which books he discussed ardently and it must be confessed with justice the valuable scientific contributions made by that very Catholic clergy of the Middle Ages which is popularly supposed to have done all in its power to prevent the spread of learning In the volume before us we have no systematic attempt to thwart the purposes of biography by fostering those of religion although it is distinctly pointed out in the preface that every one of the men whose lives are discussed from Peregrinus and Columbus to Lord Kelvin were all of them men of deep religious convictions. On the whole one will find in this book very good sketches of the lives of the great pioneers in electricity with a clear presentation of how it was that these men came to make their fundamental experiments and how we now reach conclusions in science that would have been impossible until their work of revealing was done The biographies published are those of Peregrinus Columbus Norman and Gilbert, Franklin and some contemporaries Galvani, Volta Coulomb, Oersted Ampère, Ohm, Faraday Clerk Maxwell and Kelvin

Power, Heating and Ventilation A Treatise for Designing and Constructing Engineers Architects and Students By Charles L. Hubbard B S, M E. Part I, Boiler Room Equipment, first edition Brattleboro, Vt. The Technical Press 1908 8vo., pp 216 Price, $2

The matter contained in this volume had its beginning in a pocket note book which in turn served as a basis for articles which appeared in the Technical Press from time to time Occasional calls for reprints of these articles led the author to select those having the most practical value and to combine with them others to form sufficiently new material to make up a treatise on power and heating plants The subject of power is treated more especially from the steam side but there is also reference to the requirements of electric lighting and the distribution of electric power No attempt has been made to cover central station work but plants similar to those found in factories office buildings and institutions. The illustrations are excellent the wax process being used exclusively

College Text Book of Geology By Thomas C Chamberlin and Rollin D Salisbury New York Henry Holt & Co, 1909 12mo pp 978 Price, $3 50 net.

For a number of years there has been room for a thoroughly modern work on geology which can be used as a text book At last we have an ideal book a perusal of which will benefit anyone whether he is interested in the subject or not He certainly will be after he has finished a few of the chapters. The book is elaborately illustrated with 808 engravings and a considerable number of plates many of them in color The illustrations in nearly every case are made from original photographs and are a great relief from the time-honored illustrations which one is wont to see in his geology In brief the book is divided into two parts first Dynamic and Structural Geology second Historical Geology Under the first part the materials of the earth and their arrangement The Geological Work of the Atmosphere Land Waters,

Ground (Underground) Water The Work of Snow and Ice The Work of the Ocean Lakes, Movements and Deformations of the Earth's Body Vulcanism, and Structural Geology In the second part we have The Origin of the Earth The Archeozoic Era The Proterozoic Era The Paleozoic Era, which is in turn divided into the Cambrian Period The Lower Silurian The Upper Silurian The Devonian, the Mississippian the Pennsylvanian the Permian Period We then come to the Mesozoic Era which is divided into the Triassic Period the Jurassic Period the Cretaceous Period. Now comes the Cenozoic Era which is divided into the Eocene Period, the Miocene Period the Pliocene Period the pleistocene or Glacial Period and the Human or Present Period A perusal of this work will give the reader an excellent idea of the whole subject

A Handbook of Polar Discoveries By A W Greely, Major-General United States Army Fourth Edition, Revised and Enlarged Boston Little, Brown & Company, 1909 pp 336 Price, $1 50

Major-General Greely, himself an Arctic explorer of distinction has performed a notable service in gathering in an authoritative handbook records of the principal expeditions made from the time of the early northwest voyages down to the year of 1909 In view of the Cook Peary controversy naturally one turns with some curiosity to those chapters of the book in which the claims of Cook and Peary would necessarily be discussed General Greely finds himself constrained to give full credit to both notwithstanding the sharp attacks which have been made upon the former Of his own courageous explorations he writes with characteristic modesty and yet as fully as the historical value of his work demands General Greely's volume represents more than 70,000 pages of narrative from which he has endeavored to compile such data of accomplished results as may subserve the inquiries of the busy man who often wishes to know what when and where rather than how

Mendel's Principles of Heredity By W Bateson, M.A., F R.S., V M H Fellow of St. John's College, Professor of Bilogy in the University of Cambridge Cambridge, at the University Press New York G P Putnam's Sons, 1909 pp 396

Mr Bateson is well known to students of biology as an authority on breeding and heredity In the present volume he has given a succinct account of the discoveries which have been made by the practical application of Mendel's method of research As a result of Mendel's work and its application by modern biologists in which task Mr Bateson himself has played no small part the study of heredity has become an organized branch of physiological science, already abundant in results and in promise Although the subject is by no means exhaustive, still at the present time our knowledge of the facts has reached a definite stage, and a book in which the phenomena of heredity are scientifically presented is certainly needed Such a book Mr Bateson has presented and presented moreover very ably when it is considered how diverse and many are the facts zoological and botanical, from which the material must be drawn

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 25, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abdominal belt or supporter A B Kendrick 947 413
Account register Cunin & Ferguson 947 610
Addressing machine J W Butterfield 947 529
Addressing machine plate feeding mechanism for Owens & Lyle 947 598
Agricultural machines device for driving motor A J Smensky 947 444
Air apparatus for the production of carbureted M F Millville 947 717
Air brake cylinder attachment, C P Case 947 541
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Alkali chlorid solutions apparatus for the electrolytical decomposition of J J Rink 947 741
Animal cleaning apparatus C Hammer reissue 13 078
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Bicycles, etc support for K & F Dave 947,379
Blasting charges, means for preparing and firing, C. S. Bakoey 947,289

A NEW EDISON BATTERY STREET CAR.

(Continued from page 126.)

mobiles and electric trucks. So far they have failed to develop any serious difficulties. It took the utmost patience on the part of Mr Edison to develop the battery to a state which he now considers practically "fool-proof." Naturally the public has not been so patient and has been grumbling about the long delay in developing this battery concerning which so much has been promised.

The other day the public was invited to inspect a street railway car equipped with the new batteries, which was run on a short section of track in West Orange. This car differs materially from the ordinary car not only in the power source, but in general design The amount of current to be stored in the battery is limited, and in order to make this power go as far as possible it was essential that all superfluous weight be eliminated. The question of weight is not so vital a matter in the ordinary street car and has never received a great deal of attention. Mr Ralph A. Beach, who has been Mr Edison's assistant in adapting the storage battery to traction, was called upon to build a special car that would be as light as possible He found that the common street car is merely a smaller and slightly modified steam railroad car, and it was necessary for him to branch out on entirely new lines. He guarded as jealously against unnecessary weight as the builder of an aeroplane The backbone of the car he evolved consists of two 18-foot lattice girders which extend the entire length of the body under the seats They consist of electrically welded steel bars and are so inflexible that when loaded with two tons at the center they show a deflection of but 3/1000 of an inch Around these two girders the car is built In the first place they form a casing to receive the batteries of which there are 210 cells, 100 on each side for power and 10 for lighting All the superstructure of the car is built of veneer and light woodwork with the exception of the strap rails and posts, which are of bicycle tubing and act as a framework to support the weight of the roof The roof itself consists of a single sheet of veneer bent to the proper form, and is so light as to permit of making the side posts much smaller than in the ordinary car The fact that this car does not have to support a trolley pole has allowed of using so light a roof.

The truck contains many novel features. The connection between the truck and body is such as to permit of a side and end movement of but ⅛ of an inch, although it may move vertically to a much greater degree The object of this is to insure smooth running and to prevent the usual swaying. In place of the usual car wheels light steel wheels are used The axles are divided at the center, being connected by long sleeves which permit one wheel to gain upon its mate when rounding curves or in case of a slight difference in their diameter In this arrangement will be seen the influence of the automobile There are other features as well which remind one of the automobile and show a radical departure from the common car construction In place of gearing the motors directly to the wheels a silent chain drive is used which, as automobile practice has shown, furnishes a more economical transmission owing to the fact that a large part of the sprocket wheels is in mesh with the chain, whereas in the spur gear transmission only one tooth, or at most, three teeth of the pinion, can engage the teeth of the gear. Furthermore the chain drive permits of a greater gear reduction. Commonly a 3 to 1 reduction is the most used on railway cars, whereas on the storage battery car a reduction of 6 to 1 is employed. This permits of using lighter motors, and hence forms one of the principal reasons why a chain gear was adopted.

The car is equipped with two 5-horse-power 110-volt motors which are of a very light construction. During the recent tests the car maintained a maximum

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Block and tackle devices, E. Moore	947,595
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Box, H. B. Walter	947 767
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Car wheels, alloy for making, W W Lobdell	947 248
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Cars, pay as you enter attachment for street, H J Dressel	947 698
Cars, pay as you enter attachment for street, H. J Dressel	947,732
Carboy, F S. Havens	947,740
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Cart support, hand, C E. Peckham	947 454
Cattle guard, S. C. Baughn	947 691
Ceiling and flooring construction, C. F Franson	947 590
Cement and concrete surfaces, device for roding off, J R. Gorden	947 469
Cement block machine, C N Choate	947,569
Chair, B. Horton	947 681
Charcoal and the product thereof, purifying animal, J H Utley	947,503
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speed of 15 miles per hour The total weight of the car is estimated at 5 tons, and will seat 26 passengers, whereas the ordinary street car of the same size weighs twice that amount. The battery weighs 2,700 pounds, the car body 3,500, and the truck complete 3 800 pounds It is claimed that the capacity of the batteries is sufficient to run the car continuously for 150 miles, although in regular street traffic, where a car is obliged to stop and start and crawl behind trucks, a single charge would probably carry the car but half this distance The car is to be tested on West Street, in this city, where an excellent opportunity will be given it to demonstrate its efficiency for regular street service not only as regards the battery, but the light car construction as well

ARTIFICIAL PRODUCTION OF THE VOICE.

(Concluded from page 120)

emitted by the larynx were recorded by a phonograph The following conclusions were reached

When the larynx of a dog is removed during chloroform anesthesia, the laryngeal muscles retain their ability to contract for a short period, which varies from 3 to 10 minutes, but no contraction can be produced in the muscles of a dead larynx, even if it is removed immediately after the death of the animal, because the arterial blood has escaped In order to produce the vibrations the current of air should be impelled by a pressure of from 6 to 8 inches of water as it is in the normal production of the human voice In these conditions the excised larynx of the dog barks and howls in every note of the canine register from the deep baying of a mastiff to the shrill pipe of a terrier These various notes are obtained at will by causing various muscles to contract If the stimulation is confined to the muscles which connect the two arytenoid cartilages (two small cartilages at the back of the larynx to which the posterior ends of the vocal cords are attached) these cartilages approach each other and a deep tone is produced If on the other hand, the stimulation is extended to the muscles which connect the arytenoid cartilages with the thyroid cartilage (the large V shaped cartilage at the front of the larynx, constituting the 'Adam's apple,' to which the anterior ends of the vocal cords are attached) the vocal cords are contracted and a high, shrill note results

The pitch of the note appears to be independent of the pressure of the air and the strength of the electric current, and to be determined solely by the part of the muscular system of the larynx to which the stimulation is applied The whole larynx, including the glottis and the epiglottis, changes its form with every change in pitch Hence the larynx is a musical instrument which produces various notes by changing its form and dimensions

These experiments, in addition to their purely scientific interest, explain the sudden loss of voice to which singers and public speakers are often subject. The loss of voice has nothing to do with the vocal cords, but is caused by a sudden contraction of some of the muscles which control the glottis and is analogous to the rheumatic and neuralgic pains which appear suddenly in various parts of the body

BERNARD PALISSY, THE FAMOUS FRENCH POTTER, AND HIS WORKS

(Continued from page 125)

tilizer, etc, that modern scientific research has proved to be correct He was arrested as a heretic in 1588 and immured in the Bastile, but in 1590, before his case had been disposed of, he died

Quite a number of authentic specimens of his work are in existence, and they are practically as priceless in value as they are superb in execution At the Louvre and Cluny Museums, from which our illustrations are obtained,

(Concluded on page 135)

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Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

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Inquiry No. 9016. Wanted, machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

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Inquiry No. 9020. Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

WANTED party to undertake the selling of my patent for an automatic railway switch. A firm holder specially for street and industry. Address O. Lange, 804 Garden Street, Hoboken, N. J.

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MISCELLANEOUS

PUBLIC LAND IN OREGON.–Write for free booklet "Millions of Acres Public Land Given Away in Oregon. When, how, where." Douglas County Abstract Co., Roseburg, Ore.

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Inquiry No. 9062. Wanted to buy a plant for manufacturing muriatic acid.

Inquiry No. 9065.–Wanted to buy a second hand telephone generator.

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Inquiry No. 9068.–Wanted to buy machinery for manufacturing chewing gum such as rolling cutting or wrapping machinery.

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Inquiry No. 9074.–Wanted to buy old model locomotives or steamboats, such as were exhibited with nickel-in-the-slot attachments in ferry houses, etc.

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Dish cleaner, F. Schlaht 947,460
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Display stand, K. T. Palmenberg 947,646
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Garment hook, F. E. De Long 947,771
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Home-Made Experimental Apparatus

In addition to the following articles, the Scientific American Supplement has published innumerable papers of immense practical value of which over 17,000 are listed in a carefully prepared catalogue, which will be sent free of charge to any address. Copies of the Scientific American Supplement cost 10 cents each.

If there is any scientific, mechanical, or engineering subject on which special information is desired, some papers will be found in this catalogue in which it is fully discussed by competent authority.

A few of the many valuable articles on the making of experimental apparatus at home are given in the following list:

ELECTRIC LIGHTING FOR AMATEURS. The article tells how a small and simple experimental installation can be set up at home. Scientific American Supplement 1551.

AN ELECTRIC CHIME AND HOW IT MAY BE CONSTRUCTED AT HOME, is described in Scientific American Supplement 1566.

THE CONSTRUCTION OF AN ELECTRIC THERMOSTAT is explained in Scientific American Supplement 1566.

HOW TO MAKE A 100-MILE WIRELESS TELEGRAPH OUTFIT is told by A. Frederick Collins in Scientific American Supplement 1605.

A SIMPLE TRANSFORMER FOR AMATEUR'S USE is so plainly described in Scientific American Supplement 1572 that anyone can make it.

A ¼-H. P. ALTERNATING CURRENT DYNAMO. Scientific American Supplement 1558.

THE CONSTRUCTION OF A SIMPLE PHOTOGRAPHIC AND MICRO-PHOTOGRAPHIC APPARATUS is simply explained in Scientific American Supplement 1574.

A SIMPLE CAMERA-SHUTTER MADE OUT OF A PASTEBOARD BOX, PINS, AND A RUBBER BAND is the subject of an article in Scientific American Supplement 1578.

HOW TO MAKE AN AEROPLANE OR GLIDING MACHINE is explained in Scientific American Supplement 1582, with working drawings.

EXPERIMENTS WITH A LAMP CHIMNEY. In this article it is shown how a lamp chimney may serve to indicate the pressure in the interior of a liquid, to explain the meaning of capillary elevation and depression, to serve as a hydraulic tourniquet, an aspirator, and intermittent siphon, to demonstrate the ascent of liquids in exhaustive tubes, to illustrate the phenomena of the bursting bladder and of the expansive force of gases. Scientific American Supplement 1583.

HOW A TANGENT GALVANOMETER CAN BE USED FOR MAKING ELECTRICAL MEASUREMENTS is described in Scientific American Supplement 1594.

THE CONSTRUCTION OF AN INDEPENDENT INTERRUPTER. Clear diagrams giving actual dimensions are published. Scientific American Supplement 1615.

AN EASILY MADE HIGH FREQUENCY APPARATUS WHICH CAN BE USED TO OBTAIN EITHER D'ARSONVAL OR OUDIN CURRENTS is described in Scientific American Supplement 1618. A plunge battery of six cells, a two-inch spark induction coil, a pair of one-pint Leyden jars, and an inductance coil, and all the apparatus required, most of which can be made at home.

SIMPLE WIRELESS TELEGRAPH SYSTEMS are described in Scientific American Supplements 1363 and 1381.

THE LOCATION AND ERECTION OF A 100-MILE WIRELESS TELEGRAPH STATION is clearly explained with the help of diagrams in Scientific American Supplement 1622.

THE INSTALLATION AND ADJUSTMENT OF A 100-MILE WIRELESS TELEGRAPH OUTFIT, illustrated with diagrams, Scientific American Supplement 1623.

THE MAKING AND THE USING OF A WIRELESS TELEGRAPH TUNING DEVICE, illustrated with diagrams, Scientific American Supplement 1624.

HOW TO MAKE A MAGIC LANTERN, Scientific American Supplement 1546.

THE CONSTRUCTION OF AN EDDY KITE. Scientific American Supplement 1555.

THE DEMAGNETIZATION OF A WATCH is thoroughly described in Scientific American Supplement 1561.

HOW A CALORIC OR HOT AIR ENGINE CAN BE MADE AT HOME is well explained with the help of illustrations, in Scientific American Supplement 1573.

THE MAKING OF A RHEOSTAT is outlined in Scientific American Supplement 1594.

Good articles on SMALL WATER MOTORS are contained in Scientific American Supplement 1494, 1049, and 1406.

HOW AN ELECTRIC OVEN CAN BE MADE is explained in Scientific American Supplement 1472.

THE BUILDING OF A STORAGE BATTERY is described in Scientific American Supplement 1433.

A SEWING-MACHINE MOTOR OF SIMPLE DESIGN is described in Scientific American Supplement 1210.

A WHEATSTONE BRIDGE, Scientific American Supplement 1595.

Good articles on INDUCTION COILS are contained in Scientific American Supplements 1514, 1522, and 1527. Full details are given so that the coils can readily be made by anyone.

HOW TO MAKE A TELEPHONE is described in Scientific American Supplement 966.

A MODEL STEAM ENGINE is thoroughly described in Scientific American Supplement, 1527.

HOW TO MAKE A THERMOSTAT is explained in Scientific American Supplements 1561, 1566, and 1568.

ANEROID BAROMETERS, Scientific American Supplements 1500 and 1554.

A WATER BATH, Scientific American Supplement 1595.

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Refrigerator, C. L. Haywood 947,576
Refrigerator, L. Doran 947,627
Resistance unit, E. N. Lightfoot 947,[illegible]
Reversing mechanism, J. R. Golter 947,681
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Rolling metal bars, apparatus for, I. L. Hughes 947,565
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Rotary engine, J. Nelson 947,670
Rotary explosion engine, E. J. Coulli 947,480
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Sash slide, W. F. Gibbard 947,[illegible]
Sash, window, G. T. Pulson 947,719
Saw handle, Barton & Trump 947,482
Saw set, T. F. Ward 947,[illegible]
Scale, N. Nilson 947,[illegible]
Scale, weighing, W. C. Carr 947,[illegible]
Scissors and shears, A. K. Chapin 947,[illegible]
Score board, J. P. Keenan 947,471
Scraper, road, T. & A. A. Addison 947,797
Screen. See car opening screen.
Screen sizing and separating machine, J. M. Callow 947,[illegible]
Scruff and dross, reduction of, R. S. Wile 947,[illegible]
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Sealing bottles, Tevander & Mahlerre 947,[illegible]
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Seating, W. Franks 947,[illegible]
Seeder attachment, H. Brown 947,[illegible]
Separator, J. Muchka 947,[illegible]
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Sewing machine, T. G. Plant 947,481
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Sewing machine needle, J. French 947,484, 947,[illegible]
Sewing machine, two reel, D. Flanagan 947,[illegible]
Shade rollers and curtains, adjustable support and bracket for, T. R. Johnson 947,[illegible]
Shaker, combination, H. J. Turner 947,[illegible]
Shaping machines and the like, speed box for, M. Flather 947,[illegible]
Sharpening the rotary circular knives of meat slicing machines, device for, W. A. Van Berkel 947,[illegible]
Sheet metal articles, machine for making, Adriance & Calhoun 947,[illegible]
Shingle shaper, automatic, G. A. Orrough 947,[illegible]
[illegible] 947,[illegible]
[illegible] 947,[illegible]
[illegible] 947,[illegible]

(Concluded from page 133.)

he is very completely represented by important specimens showing the three distinct styles that he adopted in the course of the development of his art. His first dishes were usually oval in form, decorated in the center and at the edges with animals, modeled after nature, fish, frogs, snakes, shells and shell-fish, reposing on flowered moss, or swimming in streams of transparent water; at the back enamel marbled in yellow, green, and red. In his second style Palissy partly abandoned the rustic decoration of his pieces, he retained only the shells as a framing and gave to the central subject the chief importance Finally, in his third style, he abandoned the rustic completely and used only the marbled enamel as a poly-chrome attraction The modeled figures then became very important and sometimes he reproduced, in poly-chrome pottery, the pewter vessels of the then celebrated Briot, such as the famous piece which represents the "triumph of temperance," of which an illustration is here presented, and he modeled in miniature sculpture and afterward colored and enameled a very diversified series of small articles, nurses, hurdy-gurdy and bagpipe players, etc.

We produce herewith a portrait of Bernard Palissy from an old French miniature of his period on vellum, that is preserved at the Cluny Museum Palissy is represented, full face and in court costume with ruffs His doublet is embroidered and relieved with gold, the sleeves are be-ribboned, and on the chest is braid Above the head appears the inscription B. Palissy

His works reflect alike genius and artistic taste, and his work was original, marvelously true to nature in execution and coloring, and probably in a more marked degree than any other master of the ceramic art, he learned to perfect colors that would be, after firing known quantities, a knowledge that enabled him to duplicate, with such wonderful certainty, the color effects of the fish, reptiles, insects, etc, he loved to reproduce The extent to which his style was imitated affords the most practical proof of the favor it enjoyed

An Electro-pneumatic Conveyor System for Libraries.

An electro-pneumatic system is used in the Berlin royal library for carrying out the distribution of books to the readers. Upon this system the reader fills out a blank containing the name of the desired book, and upon this blank an employee writes an exact indication of the place where such volume is to be found. The bulletin is then sent by pneumatic tube to the central office This office is directly connected by elevators with the different stories of the building These elevators are of small size and are operated electrically on a push-button system Besides, there is a large elevator running through all the floors for transporting persons and books. A set of pneumatic tubes also run from the central office to the different floors which contain the books. The employee of the central office who receives the reader's bulletin sends the same by pneumatic tube to the proper floor, and on this floor the attendants read the sheet and bring the desired books to the elevator which takes them to the central office. The latter office then sends the books to the point from which the bulletin was sent in the first place, either in the main reading room or any other of the rooms of the library.

Writing to Stahl und Eisen, a German manufacturer states that he has succeeded in making satisfactory high-speed steels with powdered ferro-tungsten. The steel contains 0.82 of tungsten, 0.45 silicon, 0.45 manganese, 0.30 carbon, 0.35 aluminium, calcium, and magnesium, and 0.01 of sulphur The powdered ferro-tungsten alloys more readily than tungsten metal, and there is less segregation and piping.

Shoe polishing machine G C La Mountain 947 415
Shoe tree G. B Kesters 947,387
Shovel and coal receptacle combination N R Middleton 947 452
Shovel holster, steam W Sheppard 947 158
Shutter M Kistler 947 471
Sifter flour, G McLachlan 947 694
Sign G C Stauffer 947 690
Silo W A Holmgren 947 134
Siphon W B Goodwin 947 [illegible]
Skirt S Cohn 947 170
Sled brake H A Denney 947 670
Smoker's article, J R Ring 947 70[illegible]
Snap hook F J Scharlow 947 764
Snap swivel H S Beaver 947 [illegible]
Socket shell cap fastening H Hubbell 947 [illegible]
Sound reproducing device J C English 947 [illegible]
Sounding fork vibrator electrical J Muller 947 [illegible]
Spark arrester A C Lewis 947 61[illegible]
Splice bar F A Schroeder 947 [illegible]
Spoke socket J Markwick 947 [illegible]
Spring See bed spring
Staircase metal C F Stiller 947 743
Stanchion cattle M Murphy 947 698
Station indicator C C Cochran 947 684
Still turpentine B Hart 947 062
Stone crushing machine J L Mitchell 947 067
Stool shoe salesman's G H Moore 947 518
Storage battery W M Jackson 947 [illegible]
Storage battery J F Haschk 947 [illegible]
Stove lid A J Cast 947 770
Stovepipe forming machine G Berghausen 947 [illegible]
Street indicator Carson & Johnson 947 70
Striking tool W C Michael 947 [illegible]
Structure knockdown F J Sullivan 947 65[illegible]
Surfacing machine F J Benn 947 [illegible]
Surgical appliance W C Yates 947 72[illegible]
Surgical instrument J C Grossmann 947 [illegible]
Switch See fusible switch
Switch Sarles & Hitesman 947,459
Switch, J G Arter 947 607
Table lock pedestal A Carlson 947 278
Tag fastener C M Thalimer 947 [illegible]
Talking machine sound box J P Vallonet 947 514
Tanning J M Brown 947 443
Target throwing device I A Fridell 947 390
Teeth fastening in gum for artificial T E. Dunclow 947 378
Telegraphic transmitter, P B Delany 947 324
Telephone connection registering device H S. Hulfish 947,235
Telephone lines auxiliary signaling apparatus for C N Winston 947 730
Telephone switch apparatus N A Koltonski 947,340
Templet and gage combined J Sherry 947 423
Tenpin bases machine for truing F & J Adell 947 708
Tent G D George 947 281 947 407
Thread holder W J Green 947 517
Thread holder J Rosenberg 947 649
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Tire W D Harris 947 442
Tire bolt tightener and cutter power H A Krueger 947 578
Tire case P Evans 947 027
Tire for automobile wheels etc emergency Bodenheim & Stinchcomb 947 221
Tire vehicle Clawson & Dow 947 371
Tire vehicle H S Firestone 947 543
Tire vehicle wheel cushion C Welchelt 947 585
Toaster M A Patterson 947 049
Toy gun J Scholten 947 621
Track sanding appliance F C Schwartz 947 652
Train order delivering device C B Hibbard 947 286
Transmission mechanism W C Jameson 947 398
Transmitter W F McCormick 947 393
Trestle F O Vickers 947 464
Trolley wheel G H Downs 947 430 947 758 947 759
Trough See watering trough
Truss pad or cushion D O Fosgate 947 551
Tubes or rods mechanism for treating metal or other E T Greenfield 947 440
Tubes or rods treating metal and other E T Greenfield 947 439
Turbine steam W F Neelye 947 353
Turning machine channel lip, W H Hooper 947,509
Type bar producing mechanism F H Richards 947 761
Type bars producing F H Richards 947 330
Type writing machine S Nielson 947 253
Type writing machine M W Lant 947 257
Type writing machine C B Yaw 947 269
Type writing machine A J Briggs 947 276
Type writing machine J C McLaughlin 947 417
Type writing machine F B Hess 947 448
Type writing machine I C Myers 947 450
Type writing machine G A Seib 947 469
Type writing machine pneumatically operated M Soblik 947 662
Umbrella F Benn, Sr 947 671
Uncoupling device H T Krakau 947 242
Universal joint Long & Austin 947 751
Valve T R Sundberg 947 463
Valve controlling mechanism thermostatic H Schneider 947 310
Valve hydraulically operated E Sandner 947 311
Valve stem or rod C Klem 947 593
Valve tank, A D Herschler 947 284
Vault burial J T Bult 947 402
Vault cover fastening J Armstrong 947 184
Vehicle motor B D Gray 947 637
Vehicle spring Ngal & Schwanda 947 653
Vending machine coin controlled Peters & Schmidt 947 755
Veneer drying and straightening machine F N Morey 947 306
Vessels corrugated metal wall for collapsible expansible W M Fulton 947 220
Vise bench O M Eager 947 378
Voting mechanism question C H Osmundpaugh 947 497
Wagon dumping apparatus G F Wunder 947 118
Washing machine F Stines 947 265
Washing machine W R Kramer 947 353
Washing machine J Vierling 947 565
Washing machine I R English 947 611
Washing machine W A F Henrich 947 776
Washing machine cylinders sliding door for F M Raymond 947 700
Washing machines sliding door for outer cases of sterilizing F M Raymond 947 701
Water heater F J Randall 947 321
Water heating apparatus W W Rich 947 308
Watering trough B R Spencer 947 704
Wave motor C O Blanel 947 121
Weed burner I G Davidson 947 397
Weigher fruit G D Parker 947 [illegible]
Weir prorating D A Callway 947 725
Wheel See car wheel
Whip lock and socket combined S Tilland 947 716
Winding roll speed regulator S T Nicholson 947 344
Window gutter and flashing show H H Treffer 947 050
Wire forming machine L R Compton 947 [illegible]
Wire stretcher C T Newland 947 739
Wires or conductors connection for P Schmidmer 947 001
Wood bath for extracting products from F Pope 947 420
Woodworking cutter K J Spieth 947 402
Work table for bars soda fountain counters etc J J Betzold 947 609
Wrench H A Paquette 947 140
Wrench S O Orr 947 610
Zinc oxid for reduction preparation of H Bape 947 390

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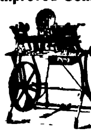

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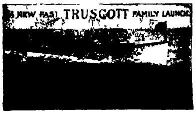

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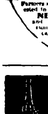

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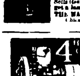

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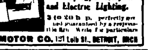

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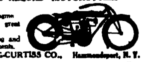

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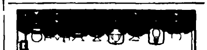

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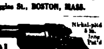

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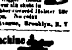

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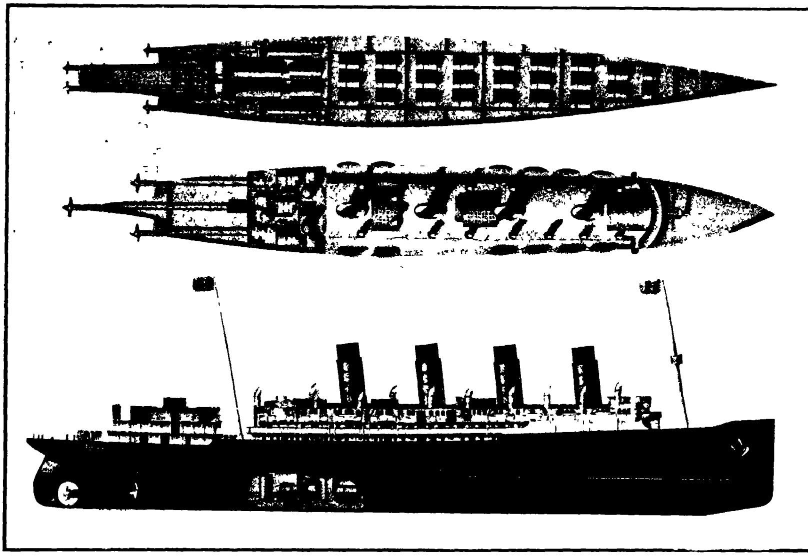

The upper engraving shows the space occupied by the boilers and engines of the "Mauretania." The two lower engravings demonstrate the large saving in space resulting from the use of high-speed turbines, driving, through reduction gears, three slow-speed propellers. They would save 1,600 tons of coal and over $5,200 on each transatlantic trip

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SPEED-REDUCTION GEAR—A WAY OUT OF THE MARINE TURBINE DILEMMA.—[See page 142.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, FEBRUARY 12th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CANADA AND THE QUEBEC BRIDGE.

ENGINEERING and architectural works of the first magnitude are to no little degree an expression in concrete form of the character of the people by whom they are built. It would be difficult to define the extent to which our impressions of the ancient Greek are based upon the architecture of his noble shrines and temples, or how far our respect for the later Roman is due to feats of engineering skill that would do credit to our twentieth century civilization.

Because of the skill and daring which are or seem to be involved, the design and erection of bridges of unusual magnitude has ever been considered one of the most difficult, we had almost said spectacular, feats of construction; and the successful erection of such structures has brought world-wide fame to the engineer and distinct national credit to the country in which the work was done. Thus the Forth Bridge stands to-day as one of the noblest monuments of constructive engineering in the whole of the British empire, and a memorial to the man who was responsible for the design has recently been placed in Westminster Abbey. So too our own beautiful and dignified Brooklyn Bridge over the East River is a lasting tribute to bridge engineering as individualized in America, and the city of Trenton has recently unveiled a monument to the memory of Roebling, the father of long-span suspension bridges.

But that selfsame notoriety which brings international fame to the man and the people who carry great engineering works to a successful issue must, in the very nature of things, throw a proportionate shadow of discredit when one of these great structures falls in utter ruin and, as in the case of the Quebec Bridge, carries nigh upon one hundred souls to destruction. This fact was frankly recognized at the time by the engineering and technical press both in this country and in Canada, and it was realized to be a matter of national importance that when the bridge came to be rebuilt, the new structure should not only be perfectly stiff and strong, but that it should embody such architectural treatment as would render it æsthetically pleasing to the eye, and worthy of that great school of bridge engineering which has sprung up and flourished in the Western Hemisphere.

When the Canadian government took hold of the matter and lent all its powerful prestige and financial assistance to the scheme, it was accepted as an augury that the new bridge would be worthy of the great Dominion across the border line. We have to confess, however, that the bridge which it is now proposed to build is decidedly disappointing. The type selected and the method of treatment are not up to the latest standards of bridge engineering. In other words, the design is distinctly commonplace. Æsthetically it has not a single redeeming feature.

In redesigning the bridge, the Canadian government could have made more sure of securing the best possible designs, if they had thrown the bridge open to world-wide competition. We should then have learned whether the strongest, most economical, and most beautiful bridge could have been secured under the cantilever or under the suspension system of design. Personally, we believe that on all three counts it would be possible to produce a suspension bridge that would be greatly superior to the structure which it is now proposed to build. The suspension bridge, especially when built of these great proportions, is a far easier bridge to erect, not being subjected to those heavy erection stresses which are the peril of large cantilever erection. Moreover, the essential elements, namely, the anchorages, the towers, and the main cables, are at all times entirely free from suspicion, and may be erected with the absolute certainty that they are well within the limits of safe construction. With these main elements assured, it is possible for failures to occur in subordinate elements, such as the suspenders and stiffening trusses, without in the least endangering the integrity of the bridge as a whole.

Not so, however, the cantilever bridge, the greater part of whose intricate framework is in compression. Let but one among the multitudinous members of the main trusses fail, and the whole structure will be thrown into immediate and absolute ruin—as witness the mass of tangled steel now lying in the St. Lawrence River.

For the credit of the profession of bridge engineering in the New World, for the prestige of the great and growing people of Canada, and above all for the greater safety of the public at large, we trust that, before the final plans of this great bridge are adopted, the Canadian government will take steps to make it certain that the final bridge will, from every point of view—engineering, architectural, and artistic—be the noblest work of its kind yet erected in any country.

CAUSES OF THE PARIS FLOOD.

THERE appears to be a consensus of opinion among the French scientists that the causes of the recent phenomenal rise of the Seine, when it reached the record height of 31 feet 2 inches, are to be found more in geological than in meteorological conditions. The basin of the Seine and the streams that are tributary to that river consists of a light absorbent soil, and, as the slopes are gentle, any sudden precipitation is ordinarily absorbed by the ground. In winter, when the soil is either frozen or saturated by the rains, there is a risk that the run-off of a heavy precipitation will be so large and sudden as to overtax the capacity of the river channels. These conditions obtained to a marked degree during the recent continuous heavy rainfall and flood. Meunier the geologist is of the opinion that the heavy rains preceding the flood found the soil of the Seine watershed so thoroughly impermeable because of saturation that the water ran off as swiftly as it would from the surface of an asphalted or cemented street. Furthermore, it seems to be generally agreed that the denudation of the forests in the higher regions of the watershed has been a contributory cause to the flood. Not only do the trees assist evaporation, but the forest undergrowth also exerts a material influence in retarding the flow of the water.

Referring again to the question of the prevention of future floods at Paris, regarding which we made editorial comment last week, there is an alternative plan to that of dredging or widening the channel and the removal of river piers which, were it not for the enormous expense involved, would afford an absolute safeguard against future disaster. We refer to the heroic measures employed by the Austrian engineers to prevent the flooding of the city of Vienna by the river Danube. This consisted in cutting an artificial channel entirely around the city, through which, after the river reaches a certain elevation, all the surplus waters are diverted and discharged into the river below the city. It would be possible to create a similar by-pass around the city of Paris, but the cost due to the great value of the land which would have to be condemned would probably be found to be prohibitive.

WATER CONSERVATION IN NEW YORK STATE.

AFTER about three years of investigation of the subject of water resources, the State Water Supply Commission estimates that 1,500,000 horse-power of water energy is running to waste every year in the State of New York, and that if this were developed according to plans drawn up by its engineers the State would realize a yearly rental of at least $15,000,000.

As a result of its investigation of the watersheds of the Hudson, Genesee, and Raquette rivers, the Commission has located and surveyed four reservoir projects for the development of water power and the control of floods. These are the Sacandaga and Schroon Lake reservoirs on the Hudson, the Portage reservoir on the Genesee, and the Tupper Lake reservoir on the Raquette. The Commission considers that the Hudson River, because of its size and the large population and important industries of the cities situated along its banks, should receive the first consideration in any system of conservation that may be adopted, and it recommends the construction at a point on the Sacandaga River, 50 miles north of Albany, of a dam and storage reservoir of 29 billion cubic feet capacity. Such a dam would convert 30 miles of the present river valley into an artificial lake of the size of Lake George.

The principal object of this reservoir would be to hold back and store the flood waters, and afford relief during the low-water conditions of the summer to the various power plants along the Hudson, by releasing sufficient water to maintain the level of the river at the desired stage for operation of the hydraulic plants. In addition to the great benefits afforded by such control of the stage of the river water, the power developed directly in connection with the big dam would be transmitted electrically to such towns as Albany, Troy, Mechanicsville, Glens Falls, Utica, Schenectady, and other less important communities lying within the zone of economical electrical transmission. It is estimated that the reservoir would cost $4,650,000, that the total yearly fixed charges and maintenance would amount to $237,700, and the annual gross earnings $427,500, leaving an estimated annual net revenue to the State of $189,800. The Commission estimates that on this basis the cost of the reservoir would be refunded to the State in fifty years, at the end of which time it would be the sole owner of the works, which would yield a perpetual income from the sale of the stored-up water.

The Commission advises that the work be undertaken by the State, because under State control the necessary funds can be provided more economically, and the interests of the public can be absolutely safeguarded. It recommends the enactment of a law authorizing the development of the power of the Hudson River, the construction of a storage dam on the Sacandaga at Conklingville, the amendment of the Constitution to permit the flooding of State lands in building storage reservoirs to be owned by the State, another amendment providing for a bond issue to meet the expense of building reservoirs, and the building of other reservoirs to regulate the flow of rivers for power purposes and flood control.

STEEL BELTS.

IN Germany steel belts are used in many large factories and electric power stations. The principal difficulty connected with their employment is that of joining the ends of the belt. These ends are now provided by the makers with steel plates which need simply to be screwed together. It is necessary to use steel of special quality and temper. It is advantageous to cover the belt wheels with coarse canvas, to which thin slices of cork are attached in order to prevent slipping. The cork lasts practically forever and reduces the sliding to less than one-tenth per cent of the travel. Prof. Kammerer has experimented with a steel strap, two-fifths inch wide and one-fiftieth inch thick, with two wheels, eight feet in diameter, for the transmission of 16 horse-power with a tension of 440 pounds. Although the wheels were not covered, they worked very silently even at a speed of 200 feet per second. The maximum slipping was one per cent of the travel and the loss of energy due to this cause was inappreciable.

Steel belts possess the following advantages. The energy is transmitted without slipping and almost without loss, the belts do not stretch, their width may be reduced to between one-third and one-tenth of that of leather belts transmitting the same power, consequently the wheels may be narrower and lighter and the workshop less darkened by them. The steel belts do not deteriorate appreciably, they may be used in damp places and do not appear to be attacked by smoke or acid. They allow the attainment of velocities of 100 feet per second and are consequently very suitable for use with turbines. The required tension is one-tenth less than that of leather belts transmitting the same power, because of the difference in weight, from which results an additional economy, owing to the diminished friction on the bearings. Much room can be saved by using steel belts because their efficiency does not depend upon their length. They can be used horizontally in place of gearing. The makers assert that they cost less than leather belts of good quality.

The oldest steel belts have been in service two years. In a Berlin factory a leather belt 24 inches wide was replaced by a steel belt 4 inches wide which transmits about 250 horse-power. The belt, after two years' use, shows no indication of wear. The only objection to steel belts is that they are not easily seen, and consequently may cause accidents if they are not carefully guarded.

A remarkable phenomenon was observed during a thunder shower in Finland in the summer of 1908 by V. J. Laine, who was making meteorological observations for the Finnish scientific society. The shower approached from the east and the thunder, which had been heard at intervals during a half hour, ceased before any rain fell at the place of observation. During approximately the same half hour the eastern horizon was completely spanned by a double rainbow, which likewise vanished before the rain came. Immediately after each peal of thunder the colors of both bows and especially those of the secondary bow, became confused and indistinct, and the whole double rainbow appeared to vibrate rapidly. Laine explains this singular phenomenon, in accordance with the Airy-Pernter theory of the rainbow, by assuming that the concussion of the air which produced the sound of thunder, also increased the diameter of the rain drops from less than 1/250 inch to between 1/50 and 1/25 inch. If this assumption is confirmed it will furnish a valuable contribution to the theory of thunder storms, which is still incomplete.

ENGINEERING.

According to a recent dispatch, a contract for the construction, at a cost of $500,000, of a dam, which will form part of an irrigation scheme in the southern section of the island of Porto Rico, has been awarded to native engineers, who secured the award in competition with four American firms. The total cost of the scheme is $3,000,000.

The heaviest rainfall ever recorded for a single day on the Isthmus of Panama occurred during the great flood of last December, between the hours of 10 A. M December 28th and 10 A. M December 29th, when the rain gage at Porto Bello showed a fall of 10.86 inches. The total fall for the month was 58 17 inches, which is equal to an average rate of nearly two inches a day

The stern frame, rudder, and brackets for the new White Star liner "Olympic," which were recently supplied by the Darlington Forge Company, are the heaviest ever cast for a steamship Their total weight is 289 tons, made up as follows Stern frame, 70 tons, after boss arms, 74 tons, forward boss arms, 45 tons, and rudder, 100 tons The total weight of the same parts as cast for the "Mauretania" was 220 tons.

The rapid elimination of the sailing vessel is shown by statistics recently given by a German paper In the twenty years between 1888 and 1908 the percentage of sailing vessels has declined in the merchant marine of Great Britain from 44 1 to 12 6, of Germany, from 62.1 to 19 1, of the United States, from 80 7 to 30 9 In the merchant marine of France, however, but little change has occurred, the respective percentages being 47 9 and 47 2.

According to the French paper Matin, the Minister of Marine is asking for the construction of two dreadnoughts of 23,000 tons each in a programme which has been recently submitted to Parliament, and he has sanctioned the arrangement of turrets adopted by the Superior Council of the Navy, which recommended two turrets containing three guns and three turrets with two guns. There will be eighteen unusually powerful guns in the secondary battery, and the speed is to be twenty knots.

The locomotive recently built for the electric operation of trains through the Cascade tunnel of the Great Northern Railway, where the electrical equipment extends for about six miles, weighs about 120 tons and is furnished with four 3-phase 400-horse-power motors working on a 500-volt, 25-cycle circuit The pressure on the line is 6,000 volts, which is reduced by transformers carried on the locomotive. The power plant, which is driven by water power, has sufficient capacity for the operation of sixty miles of the line

The Public Service Commission has recently adopted an order requiring the New York Subway operating company to install on all subway cars destination signs, similar to those now used on some of the cars of each train The company must also post in all stations, near the ticket office, a map showing the locations of its routes and the streets intersecting the subway line; and all stations must be equipped with illuminated signs, placed on the subway walls, for the purpose of warning passengers that they are approaching the station

It is claimed that the lighthouse establishment of the United States government is the most complete and efficient in the world On June 30th, 1909, the service included no less than 1,643 lighthouse keepers; and during the fiscal year of 1910, 61 additional lights, requiring the services of 47 keepers, will be established Legislation is being sought for the establishment of three additional lighthouse districts, covering Alaska, Porto Rico and the naval station at Guantanamo, and the Hawaiian Islands. The cost of the establishment last year was $5,357,000

In a recent communication to a New York paper, Mr Hudson Maxim shows the futility of attempting to work any serious destruction by the dropping of dynamite from a flying machine. He states that the destruction effected would be very much less than anyone not acquainted with the action of high explosives would suppose; and that many tons of dynamite might be exploded in the middle of Madison Square without any more serious damage than the blowing out of the windows of adjacent buildings by the rush of air toward the explosion to fill the void formed by the uprush of the heated gases and air.

A word of warning has recently been given by J N Bailey, an English engineer, to those who are contemplating an increase of their power plant by utilizing the exhaust steam of reciprocating engines in a low-pressure turbine. He states that there are cases in which a positive loss would occur if the exhaust steam were used in a turbine in preference to a feed-water heater. In one installation which came under his notice, the major part of the latent heat in the steam, which had been used efficiently in the feed heater, was wasted in the condenser into which the turbine exhausted; for, while some 96 per cent of the heat from the steam could be utilized in the feed heater, only about 5½ per cent was recovered in the turbine.

ELECTRICITY.

Less than a year ago the New York Public Service Commission of the Second District issued an order limiting the number of passengers that could be carried on each car of the Pine Hills line in Albany There was so much public dissatisfaction with this restriction that the order has recently been withdrawn.

A report on the tie and pole consumption in 1908 has recently been issued by the Census Bureau. The total number of ties purchased by electric railways for the year was 6,425,368, of which 4,592,195 were hewn and the rest sawed. A large majority of the ties were oak, the number being 2,414,403, chestnut comes second with 1,282,128, while Southern pine and cedar follow with 944,690 and 850,687 respectively The number of poles bought by electric railways and electric light and power companies was 531,497, which is considerably less than the number for the previous year The majority of the poles were cedar, viz., 285,689, chestnut comes second with 166,050

In place of the ordinary windmill type of tower hitherto used for transmission lines, a new form of tower is now beginning to find favor It consists of two columns spaced a short distance apart and connected by horizontal members The plane of the tower is transverse to the direction of the line, and at its upper end it supports a cross arm on which the transmission lines are supported The advantage of this construction over the rigid windmill type is the fact that in case of a break in the line each tower would give somewhat and distribute the strain, thus preventing the towers from being pulled over one after the other

The Illinois traction system covers a territory 90 miles wide and 225 miles long Much new work is being done along the lines of this system which requires the general manager to make frequent trips from place to place To prevent loss of time he has had a sleeper and office car built, in which he can conduct business while *en route* and which will carry him over night from one point to another The manager's car is well equipped with all the conveniences that he might desire on his trip It is provided in the forward part with an office room so arranged that it can be converted into a bedroom with four berths separately curtained off In addition to this there is a dining room and kitchen The over-all length of the car is 62 feet.

In the recent report of the Royal Commission on Canals and Inland Navigation of the United Kingdom, the following conclusions are reached on the question of electric haulage on canals, namely that a greater regularity and uniformity of speed may be maintained, that there will be less erosion of the canal banks from waves, that there will be an economy in the size of the locks because the storage capacity of barges is not taken up with propelling machinery as in tugs and steamboats, and that the electric power can be utilized for operating the locks and even for factories along the canal The experiment was made in France not long ago of providing for horse and electric haulage side by side, but this proved to be inexpedient because the electric traction was constantly retarded by the slower horse-drawn boats.

One of the exhibits at the recent Chicago Electrical Show, which attracted considerable attention, was the government aeroplane fitted with a wireless telegraph receiving and sending system The chief difficulty in fitting up an aeroplane for wireless telegraphy lies in the fact that it is strung with wires used for bracing the parts and these interfere with the reception of the message on the short antennæ available on such a machine The difficulty was overcome by stringing three strands of No. 14 copper wire along the under surface of the upper plane and connecting these strands with a loop of wire strung about the runners of the aeroplane. Conditions in the Coliseum were not such as to permit of demonstrating the advantages of such a system of antennæ, but nevertheless it was possible to carry on telegraphic communication between the aeroplane and a station in the annex of the Coliseum.

A novel proposition was presented before the recent meeting of the American Institute of Electric Engineers by Prof. W S Franklin and Mr S. S. Seyfert. They propose to reduce the length of single-phase series motors, so that motors of higher horse-power can be accommodated in the space between the drivers of a locomotive The reduction of length is effected by using a stationary exterior armature and a revolving field and removing the commutator to any convenient point. The commutator would be stationary and the brushes would have to be revolved about it by connection with the field This would provide more space for the armature windings, which in this type of motor should be stronger than the field, and would enable a better utilization of the space ordinarily occupied by the commutator The advantage of having the commutator accessible and constantly in view would offset the mechanical disadvantages of separately revolving the commutator brushes.

SCIENCE.

Count Plunkett, the Director of the National Museum of Science and Art, Dublin (Ireland), has received notice of a bequest of £5,000 to that institution, left by Mr Patrick Murphy of Newry

A crew of eleven map makers of the Geological Survey, under the leadership of Chief Topographer C H Birdeye, are mapping the Hawaiian Islands Their work will occupy all told about eighteen months, by the end of which time it is thought that they will have succeeded in making detailed maps of Kauai, Oahu, Molokai, Mauri, and Hawaii This work is preliminary to a possible extension of the reclamation service of Hawaii

Are the senses ever vicarious? The question is discussed in Nature by Prof McKendrick and by several blind men According to one correspondent the popular notion that when a person loses his sight he is compensated by the gift of ability in one, if not all, of his other faculties, is absurd He points out that the imputation of striking ability does not enable a specially talented blind man to earn his livelihood by the exercise of that ability The blind are credited with powers in music, basket making and the like but when they assert their right to live the ordinary lives of citizens they are not permitted to do so

With the ordinary moving picture machine photographs 2 5 by 1 9 centimeters are taken at about the rate of 16 per second, which is much too slow for taking a picture of a bullet or other projectile in flight Even if the rates were 60 per second no satisfactory results could be obtained In a recent number of the Zeitschrift Instrumentenk, C Cranz describes a ballistic kinematograph apparatus which gives a time interval of 1/5000 of a second so that shot photographs can be readily obtained, and from these the velocity of the shot can be found The pendulum used makes electrical connections at different points of its swing, and these are utilized to obtain the photographs

The last opposition of Mars, although eagerly welcomed by observatories of the world has by no means settled the perennial problem of Martian surface markings Mr Lowell still insists that he sees the canals Prof Ritchey has not succeeded in photographing them, and Antoniadi still doubts the existence of the canals It would seem that the time has come for astronomers to reach some definite agreement and accordingly Mr R G Aitken in a recent number of Science suggests that Mr Lowell should invite two or three students of planetary detail such as E E Barnard, W H Pickering and E M Antoniadi to come to Flagstaff to join him in observing Mars at its next opposition and thus settle once and for all what is really seen at Flagstaff

Commander Peary has placed before the Board of Managers of the National Geographic Society a proposition in behalf of the Peary Arctic Club, to the effect that the Geographic Society join with the Peary Arctic Club in an Antarctic expedition the Arctic Club to furnish as its share of equipment the steamer "Roosevelt," used by Commander Peary on his North Pole trips and the Geographic Society to furnish funds for the other expenses to the amount of $50 000 the expenses above $50,000 to be borne equally by the Geographic Society and the Peary Arctic Club Commander Peary declines to head the expedition himself, believing that the work should be intrusted to younger men Should the plan be carried into execution it is not unlikely that almost all members of the successful Peary North Pole expedition will proceed to the Antarctic in the Roosevelt

Prof. Frank H. Knowlton of the U S Geological Survey, has just published in the Smithsonian Miscellaneous Collections a short paper entitled Descriptions of Fossil Plants from the Mesozoic and Cenozoic of North America." The paper includes descriptions of two new fossil chain-ferns, the first of which called *Woodwardia maroni*, was found in the Fort Union formation near Rock Springs, Wyoming It is of special interest from the fact that it is very closely related to the common chain fern so widely distributed over eastern North America from Nova Scotia to Ontario and Michigan, and south to Florida Louisiana, and Arkansas The other new species which he names *Woodwardia columbiana* is from the Pleistocene and was found at the Cascades of the Columbia River in Oregon It, likewise, resembles closely a living species originally described from Mexico, but also found in Guatemala Arizona, California, and Washington Prof Knowlton also describes a *Dennstaedtia americana*, which is characteristic of the Fort Union formation, never having been found outside of it This fern has its closest affinity with a living species found widely spread over China, Japan, tropical Asia, Polynesia and Madagascar These three new ferns were found in excellent condition, showing the fructification, and are of special interest on account of their close resemblance to forms now living a very unusual experience with fossil plants.

A NOVEL AMERICAN MONOPLANE

The monoplane illustrated herewith is one of the most novel aeroplanes which has thus far been produced. It is the invention of Mr. A. L. Pfitzner, who for some time past has been associated with Mr. Glenn H. Curtiss in the production of his aeroplanes.

This new monoplane, while resembling the Curtiss biplane in some features, is a distinct departure from the usual type of single-surface machine such as produced abroad by Blériot and the Antoinette Company. Unlike these machines, there is no square or triangular body extending the length of the machine and carrying a pair of wings near its front end. In place of this there is a single plane mounted upon four vertical wood struts at its center, and having a fixed horizontal tail 10 feet at the rear and a single-surface horizontal rudder 14 feet in front. The vertical rudder is placed in front just above and at the center of the horizontal rudder. Both rudders are therefore always within the view of the aviator. They are controlled by a single wheel placed vertically in front of the aviator. This wheel also operates sliding panels on the under side of the monoplane at each end for the purpose of maintaining the transverse stability. The fact that all three controls are operated by a single wheel makes this machine the simplest to drive of any thus far produced.

The plane has a spread of 30 feet and a fore-and-aft width of 6 feet. The plane itself is but 31 feet x 6 feet, equivalent to an area of 186 square feet. The sliding wing tips are each 2½ feet by [illegible] feet from front to rear. The horizontal rudder is 6 x 3 feet in size, and the vertical rudder 3 feet long by 2 feet high. The dimensions of the tail surface are 6 x 2 feet. The total weight of the machine, the tanks being filled with 6 gallons of gasoline and 1 gallon of oil, and the radiator with 1½ gallons of water, is 490 pounds. The weight carried per square foot is therefore slightly more than 3 pounds.

The four vertical posts forming the chassis terminate in forks of seamless steel tubing, each of which carries a 20-inch pneumatic-tired wheel. The posts are spaced apart by steel tubing braces and by wooden skids extending from the front to the rear. The front edge of the main plane is mounted upon these uprights 46 inches above the ground. The rear edge, which is formed of steel cables stretched over the ribs, is 10½ inches lower than the front edge where it crosses the main vertical uprights. The ribs have a slight curvature of about 1 in 19, the camber being 3¾ inches in the length of 6 feet. The center of pressure is located about 18 inches back of the front edge of the plane. The ribs are laid upon two main spars running the entire length of the machine, the foremost of which forms the front edge of the plane, while the rear one is 10 inches in advance of the rear edge and rests in sheet steel sockets attached to the heavy main ribs that connect the central vertical uprights. At suitable distances from the center of the machine on these front and rear spars vertical struts are attached to them for the purpose of trussing the plane. The 25-horse-power 4-cylinder 4-cycle Curtiss water-cooled motor is mounted upon two laminated beams extending from a cross tube at the rear through the monoplane surface to the front edge. The rear of the motor is substantially braced by four diagonal tubes, as can be seen in one of the photographs. The propeller, especially designed by Mr. Pfitzner, is 6 feet in diameter and gives 235 pounds thrust at 1,200 R. P. M., or 9.4 pounds to the horse-power. The oil tank is seen just below the surface of the plane in the photograph just referred to. The oil is cir-

(Continued on page 150.)

Copyright 191[illegible] by H. M. B[illegible]er.

Rear view of monoplane, showing novel sliding wing tips.

This view shows the fixed tail at the rear and the horizontal rudder with vertical rudder above it in front of the single plane.

Mr. Pfitzner at the control wheel of his monoplane.

This view shows the single control wheel, the power plant, and the ribs and trussing of the plane.

THE FIRST AMERICAN MONOPLANE TO FLY

NEW OVERHEAD ELECTRICAL CONSTRUCTION ON THE N. H. R.R.

The New York, New Haven & Hartford Railroad Company is so well satisfied with the operation of its electrical zone from Stamford to New York that it has decided to extend the electrification for another forty miles to New Haven. The company is also

(Continued on page 154.)

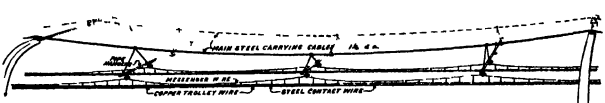


Diagram showing details of new overhead construction.

General view at Glendale showing the light and pleasing appearance of the construction.

Near view of a pair of curved supporting columns, showing a triangulated pipe hanger, suspended from the two 1¼-inch main carrying cables.

THE NEW OVERHEAD SYSTEM OF THE NEW HAVEN RAILROAD ELECTRIFICATION

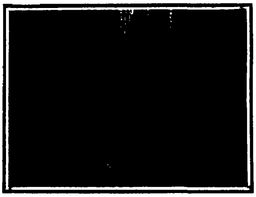
SMOKELESS POWDER—METHOD OF MANUFACTURE.—II.

BY ROBERT G SKERRETT

In the issue of the SCIENTIFIC AMERICAN of February 5th it was shown how greatly the improvements in the power of naval guns are due to the introduction and development of smokeless powder The present article is devoted to the description of its manufacture

The base of our smokeless powder is cellulose—that wonderful and yet indescribable form of matter Cotton is one type of pure cellulose

In 1832 Braconnot discovered that starch dissolved in nitric acid and when cleansed in water became an intense explosive. A little later Pelouse obtained the same results by soaking cotton fabrics in that acid



The nitrating house is like a great, gloomy steam laundry the cotton being digested in centrifugal wringers like those in which clothes are washed

and then washing them in water This was the first step in the evolution of smokeless powder Because of the great violence and erratic behavior of the explosive thus discovered it took years to develop it into a safe propellant More than half a century ago Austria and later Prussia used nitrocellulose in their ordnance but its impetuous action could not then be properly curbed and a series of accidents and unexpected explosions caused its abandonment Years later when the speedy torpedo boat and the rapid fire gun arrived French chemists through stress of need found ways to check the explosive violence of gun cotton and to fashion it into a safe and practical propellant We followed France but our powder has been the immediate offspring of that produced by the great Russian chemist Mendeleff

It seems paradoxical that we should seek for a safer and less violent propellant than common gunpowder by adopting for a base an explosive well known to be more vigorous and more unruly The secret discovered by the chemists proved nitrocellulose to be amenable to the influence of deterrent agents which subdue the suddenness of explosion while the form of the grains regulates in a remarkable way the rapidity with which the granules burn and generate the propelling gases Smokeless powder can now be made in grains of such size and such form that the conditions imposed by each caliber of gun can be met and the muzzle velocity of the shot regulated with astonishing precision Thus the task of the ordnance engineer is now quite opposite to that of former days To day the gun is designed to meet certain requirements while the propellant is afterward made to suit the gun

Now for the manner in which harmless cotton is transformed into a ballistic agent at the Naval Powder Factory Indian Head Md No official secrets are betrayed because the value of the process lies in the nice proportioning of the various ingredients combined with particular forms of grains These niceties are the outcome of lessons learned after much experimenting in which the variation of a tiny fraction of an inch may either make or mar the product

Cotton when steeped in nitric acid becomes soluble in a mixture of ether and alcohol if the percentage of nitration be less than 12 75 and is insoluble when the measure of acid is above this arbitrary dividing line When below this percentage nitrated cotton which by nitration becomes an explosive—may be dissolved into a plastic substance and when the ether alcohol solvent has in its turn been evaporated the cellulose becomes a hard tough translucent mass Before hardening however the stuff is pressed into grains of various shapes which burn with a bright orange flame and without smoke Our smokeless powder is a brother of collodion so useful in medicine and the art of photography while celluloid in its endless applications is a first cousin and lies just beyond the dividing line of those substances soluble in ether alcohol

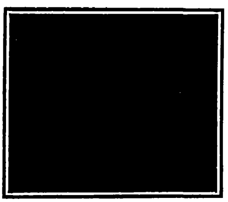
The cotton used may be either the blooms straight from the fields or the white mill waste In either case the cotton is cleansed by an alkaline bath and then well dried in an atmosphere of 212 d g F The workmen toil in this temperature but the perfect dryness of the air explains why they are not boiled alive The object of the drying is to make the cotton more absorptive in the acid thus insuring more nearly perfect nitration After the cotton has b n dried it is

The powder is forced through macaroni dies in the form of an endless rope, perforated from end to end with a concentric group of circular passages

packed in air tight canisters and sent to the nitrating house where it is soaked for half an hour in a strong mixture of sulphuric and nitric acids The reaction frees from the cotton a percentage of moisture which if not withdrawn would dilute the nitric acid and affect the character of the product Sulphuric acid has a strong affinity for water and it extracts the moisture thus leaving the nitric acid unimpaired and capable of doing its full work upon the cotton

The nitrating house is n t unlike a big steam laun

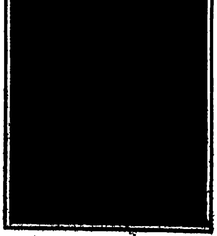
(C ntin d n pag 1 1)



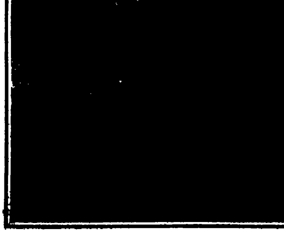
This view shows the important process of washing the cotton in the alkaline bath for the purpose of removing all traces of oil.

The "pyro" is piled into open tubs, and transported to steaming tanks, where it is boiled and boiled to extract the major part of the clinging acid.

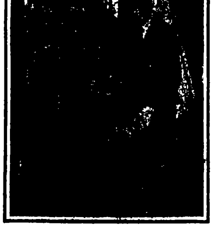
Running the fine pulp through the "wet-machine," whence it comes from the rollers in flakes containing about 40 per cent of water



One of the mechanical kneaders in which the "pyro" is mixed with the ether-alcohol solvent, and converted into "colloid," before pressing it into solid cylinders.



The dehydrating house, where all but a very small percentage of the moisture is extracted by pressure and finally by the use of alcohol to drive the dampness before it and leaves enough of the spirits behind to form the needful solvent.



In the drying house, where the powder grains are stored away and dried to the proper stage, before testing and sealing away in air-tight tanks

HOW SMOKELESS POWDER IS MANUFACTURED.

A WAY OUT OF THE MARINE TURBINE DILEMMA.

Provided that it can be run at the high speed at which its full efficiency can be assured, the steam turbine is the most economical of all steam engines On land, as a drive, say for electric generators this high speed of rotation can be employed, since a type of generator may be coupled up that is suitable to that speed When the steam turbine is employed to drive the propellers of a steamship, it is no longer possible to run it at the best speed for economy, and this for the reason that the propeller at the outward end of the turbine shaft shows its own best efficiency at speeds of rotation far lower than those demanded by the turbine If we run the shaft at the maximum-efficiency speed of the turbine, there will be a big loss of efficiency at the propeller If we run the shaft at the maximum-efficiency speed of the propeller, there will be low efficiency in the turbine

Here we have a dilemma which the marine engineer has hitherto found it impossible to avoid He has attempted to cut the Gordian knot by a compromise, and has tried to find a mean speed of rotation (too slow for the turbine, too fast for the propeller) which would give the best or rather the least bad results on the "coal per horse-power per hour" basis

It requires no very keen discernment to perceive that the solution of the problem lies in the selection of some suitable speed reducing mechanism between turbine and propeller, and as far back as 1904, in a report to George Westinghouse, George W Melville, the former Engineer in Chief of the Navy, and Mr John H MacAlpine, made the following statement' If one could devise a means of reconciling, in a practical manner, the necessary high speed of revolution of the turbine with the comparatively low rate of revolution required by an efficient propeller, the problem would be solved, and the turbine would practically wipe out the reciprocating engine for the propulsion of ships The solution of this problem would be a stroke of great genius '

In the intervening years three entirely different methods have been devised for meeting the difficulty One is to install high-speed turbo-generators, and utilize the current to drive slow speed motors direct-connected to the propeller shaft and experimental work in this direction has given such good results that the Fore River Shipbuilding Company recently put in a bid for the equipment of our 26 000-ton battleships with an installation of this character In another system known as the hydraulic reduction drive, two hydraulic turbines are interposed between the steam turbine and the propeller the one connected to the turbine the other direct-connected to the propeller, with controlling valves between the two which enable the speed to be reduced to any desired extent For both of these systems it is claimed that high efficiency has been secured The third method (the one shown in the accompanying illustration) consists in the use of a mechanical reducing gear During a series of exhaustive tests recently made at the Westinghouse shops, this experimental gear showed the astonishingly small friction loss of one and one half per cent These results are far superior to those obtained with the other two methods, and unless some unforeseen disadvantages should develop when the full-size gear comes to be installed on a warship or merchant steamer it may safely be said that in this reduction gear has been found the final solution of the marine steam turbine problem

It was no easy task to devise a gearing which would run smoothly and without excessive wear at the high speeds required for steam turbines, and at the same time transmit the thousands of horse-power carried by propeller shafts, which amounts in the case of the 'Mauretania' to about 18,000 horse-power per shaft. The experimental gear which is illustrated on the front page of this issue was constructed at the Westinghouse Works at Pittsburg where it has already undergone, and is still being subjected to a series of tests It was realized that if the results were to be convincing the experimental plant must be on a large scale and the gear was therefore designed to transmit continuously no less than 6,000 horse-power

As will be seen from the illustrations, the gears are helical that is to say, they do not run straight across the face of the wheel parallel to the axis, as in the case of ordinary spur gears, but they are cut in the form of a steep spiral This construction allows the wheels to roll into contact without shock or jar Of course, this helical form of tooth causes a strong end thrust in the direction of the axis of the shaft, and in order to prevent this, one-half of the gear was cut with the spirals running in one direction and the other half with the spirals in the opposite direction In this way the end thrust, due to the obliquity of the teeth, is completely balanced

In spite of the marvelous accuracy with which the teeth of gears can be cut by modern machinery, it is impossible to form them so truly and align the shafts so perfectly as to get an absolutely uniform contact throughout the entire length of the gear This is an important consideration in all gears, but becomes doubly so when, as in this case, they may have to transmit from ten to twenty thousand horse-power

The inventors have met the difficulty by a very ingenious construction designated as a floating frame, which they describe as follows "The frame which carries the bearings for the pinion is a heavy steel casting supported only at a single point midway between the bearings. This support is flexible, so that the frame is free to oscillate in a vertical plane passing through the axis of the pinion, but is held securely against motion in any other direction. Furthermore, the pinion is free to move endwise in its bearings Any tendency of the teeth to bear harder at one end of the gear than the other would tend to unbalance the respective end thrusts due to the right and left-hand spirals of the teeth, but as the pinion cannot present any resistance to unbalanced end thrust, it constantly adjusts itself in the direction of its axis to the position corresponding to equilibrium between the opposing forces. This means that the tooth contact pressures are always automatically equalized

"If there are any minute irregularities in the spacing of the teeth, which would tend to make the contact harder at one point than another in any part of the revolution this tendency is defeated by the floating frame, the position of which about its central support or fulcrum is controlled solely by the pressures of the teeth of the pinion against the teeth of the large gear Naturally, the floating frame always yields under the slightest tendency of an unbalanced contact pressure, in such a way as to transfer the smallest increment of unbalancing pressure to another section of the gear that, in the absence of the floating frame, would be less inclined to take its full share of the stress In short, the gears are self-adjusting to relieve and equalize all abnormal strains, and are consequently independent of the small inaccuracies that are impossible to eliminate in the best commercial manufacturing operations"

The gear was tested by means of a special hydraulic brake, the reduction gear being interposed between the turbine and the brake, and in six tests the brake horse-power delivered by the gear at different speeds varied from 3,712 to 5,927 Since there is no way in which to measure the indicated horse-power of a steam turbine, it was necessary to establish the exact brake horse-power in some other way Fortunately, it is a characteristic of the steam turbine that, as long as the speed and exhaust pressure are maintained contant, the absolute inlet pressure of commercially dry steam is a very accurate measure of the brake horse-power the turbine is developing Accordingly, a dynamometer, connected directly to the turbine shaft, was substituted for the reduction gear, the turbine was run at a fixed speed, a constant vacuum was maintained in the exhaust pipe, and the inlet pressures corresponding to different loads at this speed were determined From these tests the following results were obtained

B. H P delivered by gear	B. H P of turbine as determined from inlet press, etc.	Efficiency
3,712	3,771	98.7
4,156	4,197	99 0
4,576	4,628	98.9
5,036	5,108	98.7
5,486	5,567	98.5
5,927	6,057	98 7

A reliable check upon these results is afforded by the rise in temperature of the oil with which the gear is lubricated since the transmission loss in the gear appears as heat in the oil By measuring the quantity of oil circulated and noting its rise in temperature, a close approximation to the number of British thermal units lost per hour is obtainable When the gear was delivering 5,088 horse-power, 591 pounds of oil were circulated, with an average rise in temperature of 9.86 deg. F, from which it follows that the total heat absorbed per hour was 164,208 British thermal units As 2,545 British thermal units per hour is the equivalent of a horse-power, the total heat accounted for in the oil is 64 17 brake horse-power; and since the total brake horse-power delivered by the gear is 5,088, it follows that the efficiency must be 98.75 per cent. In view of this remarkable coincidence of results, we agree with Mr H E. Longwell, the consulting engineer, that the efficiency of the gear is conclusively established as more than 98.5 per cent. The results are, of course, a great surprise and quite unprecedented, but in view of the remarkable adjustability afforded by the floating frame, they are well within reason

With these results before him, Mr Westinghouse has made an investigation of the economies which could be secured by applying the gear to the Cunarders "Mauretania" and "Lusitania," which are each capable of developing 70,000 horse-power If the same high efficiency can be secured on board ship as has been clearly established in the testing room, the results which he arrives at seem to be well founded. It is known that the propeller efficiency in these ships is low, and probably does not exceed 55 per cent. If so, the actual effective propelling power is only about 38,500 horse-power. At the lower speed of revolution resulting from the use of the reduction gear, propellers could be installed that would have an efficiency of not less than 65 per cent; which means that the shaft horse-power required for the same effective propelling power would be less than 57,000—a saving of about 15 per cent. This means that the "Mauretania," without sacrificing her speed of over 26 knots, could reduce the boiler equipment and the coal consumption on each voyage about one-seventh.

But, in addition to this economy at the propeller end of the shaft, there would be corresponding and even greater economies realized at the turbine. For it is well understood that for equal efficiencies in any two turbines the number of rows of blades is, roughly speaking, inversely proportionate to the squares of the respective peripheral speeds of the rotating elements. But the peripheral speed of the rotating elements in the turbines of the "Mauretania" and "Lusitania" is only one-third of the speed common to large turbines used on land. This would mean that to obtain the efficiencies common to the latter, the "Mauretania's" turbines would require approximately nine times as many rows of blades, which would make a machine of prohibitive length To maintain the same speed of revolution and increase the peripheral speed of the turbines to that of turbines in land practice, the rotors would have to be nearly 40 feet in diameter

Now, the steam consumption of the turbines of the "Mauretania" is believed to be about 14.5 pounds per shaft horse-power per hour; but it has been proved that in turbines of similar capacity, operating at speeds which the reduction gear makes possible for marine service, the steam consumption does not exceed 11 pounds per shaft horse-power per hour This means that the boiler capacity, already reduced, as we have seen above by the increased efficiency of the low-speed propeller, could be further reduced to about 45,000 horse-power, and the total efficiency of the whole installation would result in a reduction of over 35 per cent in the coal consumption These vessels burn about 4,700 tons per voyage, and since the coal costs about $3 25 per ton, the saving in coal alone would be $5,300 per voyage, to say nothing of the reduced cost for wages, food etc, for the smaller number of stokers that would be required A further valuable advantage would be that the reduction of over 1,600 tons in the coal required for each voyage would add that amount to the cargo capacity

But there are further economies, as will be seen by reference to the illustrations on our front page, which show the space occupied by the present turbine equipment of the "Mauretania" and that necessary if small high-speed turbines combined with reduction gears were employed on three propeller shafts. These remarkable engravings speak for themselves, and further comment is unnecessary

All the advantages that would result from the employment of this device on merchant steamers would be realized also on naval vessels, together with other collateral advantages due to the fact that the high-speed turbine would not suffer the large drop in economy which results, in the case of the present turbines, when they are operating at cruising speeds. With the superior steam economy of the high-speed turbine the boiler capacity would be reduced fully one-third, and with the same bunker capacity the radius of action would of course be enormously increased—a consideration of incalculable importance in the extended operations of a naval campaign

The Current Supplement.

Among the big things which the big State of California produces are ostriches. These birds are discussed by C F Holder Mendel's laws and the origin of species are popularly discussed by Prof Otto N Witt. Herbert A. Humphrey writes on an internal-combustion pump and other applications of a new principle. His aim has been to produce a pump of more simplicity and strength of construction, in which the explosive force is exerted directly upon the water, and in which no rotating flywheel, solid piston, connecting rod, crank bearings, or glands of any sort are required He describes the results of his experiments with very successful types of pumps, which have been set to work on a sufficiently large scale to demonstrate their utility and economy. Some interesting notes on Halley's comet appear in the current SUPPLEMENT, No. 1780, together with an illustration showing how the earth will be immersed in the comet's tail on the night of May 18th next. The second installment of the paper of Munroe and Hall on combustion and explosion—a primer on explosives for coal miners—is published. Dr Ludwig Staby writes on the earth's pendulation and its effect. Census Director Duran contributes a most interesting description of the methods to be followed in the present census for counting our population by machine. The death of Delagrange calls forth an article on aeroplane accidents.

Notes on Halley's Comet.

EPHEMERIS OF HALLEY'S COMET.
Computed at Goodsell Observatory.

Greenwich Midnight 1910		α 1910.0 h. m. s.	δ 1910.0 ° ′ ″	log r	log Δ	Br
Feb.	3	0 59 44.3	+8 14 54	0.1914	0.2396	17
	4	0 58 23.8	8 12 33			
	5	0 57 04.6	8 10 22			
	6	0 55 48.2	8 08 22			
	7	0 54 33.9	8 06 30	0.7843	0.2489	17
	8	0 53 21.6	8 04 47			
	9	0 52 11.3	8 03 13			
	10	0 51 02.9	8 01 47			
	11	0 49 56.3	8 00 29	0.1564	0.2570	18
	12	0 48 51.2	7 59 19			
	13	0 47 47.8	7 58 17			
	14	0 46 46.0	7 57 22			
	15	0 45 45.7	7 56 33	0 1375	0.2039	19
	16	0 44 46.8	7 55 51			
	17	0 43 49.2	7 55 15			
	18	0 42 52.9	7 54 45			
	19	0 41 57 7	7 54 20	0 1177	0.2696	20
	20	0 41 03.5	7 54 01			
	21	0 40 10.8	7 53 47			
	22	0 39 18.1	7 53 38			
	23	0 38 26.7	7 53 33	0 0968	0 2740	22
	24	0 37 36.2	7 53 33			
	25	0 36 46.4	7 53 37			
	26	0 35 57 3	7 53 45			
	27	0 35 08.9	7 53 56	0 0748	0.2769	24
	28	0 34 21 0	7 54 10			
Mar	1	0 33 33.6	7 54 28			
	2	0 32 46 7	7 54 48			
	3	0 32 00 1	7 55 10	0 0615	0.2782	27
	4	0 31 13 9	7 55 35			
	5	0 30 27 9	7 56 02			
	6	0 29 42.1	+7 56 30			
	7	0 28 56.5	+7 57 00	0.0270	0 2779	30
	8	0 28 10 9	7 57 31			
	9	0 27 25 4	7 58 03			
	10	0 26 39.8	7 58 36			
	11	0 25 54 2	7 59 09	0 0012	0 2758	34
	12	0 25 08.4	7 59 42			
	13	0 24 22 4	8 00 15			
	14	0 23 36.1	8 00 47			
	15	0 22 49 5	8 01 18	9 9740	0 2717	39
	16	0 22 02 6	8 01 48			
	17	0 21 15 2	8 02 16			
	18	0 20 27 4	8 02 43			
	19	0 19 39 1	8 03 07	9 9457	0 2652	46
	20	0 18 50 2	8 03 29			
	21	0 18 00 7	8 03 48			
	22	0 17 10 6	8 04 05			
	23	0 16 19 9	8 04 18	9 9164	0 2563	55
	24	0 15 28.5	8 04 28			
	25	0 14 36.4	8 04 33			
	26	0 13 43 6	8 04 35			
	27	0 12 50.1	8 04 33	9 8805	0.2443	66
	28	0 11 55.8	8 04 26			
	29	0 11 00 9	8 04 14			
	30	0 10 05 4	8 03 58			
	31	0 9 09 2	+8 03 37	9 8369	0 2289	82

During December Halley's comet became bright enough to be seen with telescopes Several have reported views of it with four and three-inch telescopes Prof Philip Fox, director of Dearborn Observatory, saw it during the total eclipse of the moon on the morning of November 27th with the 3¾ inch finder of the 18-inch telescope

According to the Harvard Astronomical Bulletin No 379, Prof E. E. Barnard photographed the comet with the Bruce telescope on December 29th, and finds upon the photograph a very faint tail in position angle 69 deg with a length of 10 min The tail was very slender and straight

According to Prof E B Frost, director of Yerkes Observatory, Halley s comet will be visible to the naked eye about April 1st. It will cross the face of the sun on May 18th at which time the earth will be plunged in the comet's tail for a period of several hours The time of the comet's transit will be rather unfavorable for eastern observations, but undoubtedly it will be observed from the Lick Observatory in California and through other western telescopes. The comet will be visible to the naked eye about April 1st in the morning sky just before sunrise After it crosses the sun it will appear in the evening sky just after sunset

Atmospheric Electricity as a Source of Power.

The futility of the schemes often promulgated for utilising the electricity of the atmosphere, with its tension of many thousand volts, is made plain by the following considerations. According to the most reliable measurements that have been made, the strength of the current flowing from the air to the earth is about 10^{-16} ampere per square centimeter The maximum tension may be estimated at 100,000 volts Hence the influx of energy per square kilometer cannot permanently exceed $10^{-16} \times 10^{5} \times 10^{10}$ watt, which is equal to 1/10 watt This is equivalent to 1 kilowatt for each 10,000 square kilometers (3,861 square miles) or 1 horse-power for each 7,460 square kilometers (2,880 square miles) of the earth's surface, and amounts to about 50 horse-power for the whole of the German empire, and 50,000 horse-power for the entire surface of the globe.—Prometheus.

What is declared to be the largest and most expensive leather belt ever made for driving purposes has been recently shipped from New York. The belt is 240 feet long, 6 feet wide, three ply thick, and was constructed at a cost of $7,300. To make the belt the hides of 540 steers were required.

Correspondence.

THE FIRST "ALL-BIG-GUN" SHIP.

To the Editor of the SCIENTIFIC AMERICAN

In glancing over your issue of November 20th, I was struck by your correspondent's interesting article, "A Dreadnought of 1863" However, does it not seem more logical to go back a year earlier to Ericsson's "Monitor," which was without doubt the first "all big-gun" ship built. The "Roanoke" was really a combination of the "Merrimac" and the "Monitor" being like her antagonist, a rased frigate, and resembling the "Monitor" in the matter of her turrets, therefore, it appears that the "Monitor" was the original dreadnought, and the present mighty vessels of that class are but the design of the great Swedish American engineer applied to ocean-going vessels. For be it known that Ericsson never intended to employ the "Monitor" vessels for any other than coast defense duty

Brooklyn, N Y — GERALD ELLIS CRONIN

SIGHTING A RIFLE.

To the Editor of the SCIENTIFIC AMERICAN

I was interested in Mr Woodland's article, "Sighting a Rifle," in your January 22nd issue, and I would like to mention a point which I think he has overlooked, viz., the jump of the rifle This term refers to the angle through which the barrel recoils while the projectile is traversing the barrel In off hand shooting, the rifle recoils upward, and sometimes slightly sideways about a center which is probably a little forward of the butt plate The correction for this should be applied to both sights, and directly proportional to their distances from the center of recoil, but as the rear sight is very near this center, and has little vertical movement due to the jump, it is sufficient to elevate the front sight through this angle (This is done by the manufacturer, notice the high front sight of a six shooter which always has a considerable jump) Mr Woodland's plan was evidently to make the correction on the rear sight only, and while this would keep the front sight lower, and would correct the *angle* of jump, it still introduces a constant vertical error at all ranges—an error equal to the vertical movement of the front sight While this is small, and perhaps negligible for the 0 22 calibers, it would still affect his calculations slightly The bullet would strike a little high, tending to intersect the line of sight nearer in the ascending branch and farther in the descending branch of the trajectory

Chappaqua N Y — A. W BEDELL

CURIOUS FACTS ABOUT SQUARES AND CUBES.

To the Editor of the SCIENTIFIC AMERICAN

I have discovered the following curious facts about squares and cubes. These facts, in my opinion, are interesting from a scientific point of view besides being of some practical use I shall be very glad to have you publish them if you deem them of sufficient worth.

1 To be a square a number must have for its unit's digit one of the digits 0, 1, 4, 5, 6 or 9 This, of course, is well known but I put it down as an aid in understanding the other facts.

2 To be a square a number, if its unit's digit be 0, 1, 4, 5, or 9, must have for its ten's digit 0, 2, 4, 6, or 8, i e, the ten's digit must be zero or an even number If the unit's digit be 6 the ten's digit must be 1, 3, 5, 7, or 9 i e, an odd number If the unit's digit be 5 the final digits of the number must be 025, 225, 0625, or 5625 If the units digit be 0, there must be an even number of zeros at the end of the numbers.

3 A number, to be a square, must have as remainder when "nines are cast out" of it either 0, 1, 4, or 7 Since the sum of the digits of a number gives the same remainder when divided by 9, as when the number is divided by 9, this test is easily applied by dividing the sum of the digits of the number to be tested by 9 To this test I can give an algebraic *proof*

4 A number, to be a cube, must have as remainder when "nines are cast out" either 0, 1, or 8 This fact also I can prove by means of algebra

I can furnish you with a device, if you desire it, by means of which, the squares of the numbers 1 to 25 being given, the squares can be written off in order *ad libitum* without any multiplications

Normal School, Peterboro — G H KIRBY

MISS PECK AND MRS. WORKMAN.

To the Editor of the SCIENTIFIC AMERICAN

After her ascent of the lower north peak of Mount Huascaran in Peru in 1908, Miss A Peck wrote in Harper's Magazine and in other periodicals and papers the following

"It may be regarded as certain that Huascaran is above 23,000 feet, hence higher than Aconcagua, 22 800 feet, and the loftiest mountain known on this hemisphere If, as seems probable, the height is 24 000 feet, I have the honor of breaking the world's record for men as well as women"

Knowing from her own statement that Miss Peck made no instrumental observations above 19,600 feet on Huascaran, and believing, furthermore, Aconcagua to be the highest mountain of the Andes, I decided to test the truth of these assertions by sending expert European engineers to make a detailed, up-to-date triangulation of the two summits of Mount Huascaran

The only previous known measurement of this mountain was made many years ago, which is said to have given a height of 22 180 feet for the south or higher summit.

Prof Schrader, who a few years ago made the most authentic measurement yet made of Aconcagua and M Henri Vallot, both well known French scientists and heads of the Société Genérale d Etudes et de Travaux Topographiques of Paris undertook to assist in getting up the expedition, and gave the matter their close personal attention

M de Larminat, expert engineer who has carried out important survey work for the above society was selected as chief of the mission In July 1909 accompanied by two other competent topographers, he started for Peru

Favored by good weather conditions and assisted as to transport by the Peruvian government they executed a careful and detailed survey from the sea to Yungay and by actual measurement established the heights of four stations in the Black Cordillera; from each of which they triangulated the two peaks of Huascaran, so that Huascaran now stands as one of the most accurately measured high Andean mountains

The results are Height of north peak climbed by Miss Peck, 21,812 feet, of south peak still unclimbed, 22 187 feet These figures may vary by a few feet but not many when the calculations are finally gone over by M Vallot for verification

Mount Aconcagua nearly 22,900 feet, still remains, as I predicted and as Sir Martin Conway and other Andean explorers have always maintained, the highest peak of South America

Miss Peck's highest ascent to date therefore stands, north peak Huascaran 21 812 feet instead of 24 000 feet, as she estimated it, and she has not the "honor of breaking the world's record,' either for men or women, for my two highest ascents of respectively 22 568 and 23,300 feet debar her from that honor in the case of women while a number of men have made ascents exceeding her highest

Algiers — FANNY BULLOCK WORKMAN

Official Meteorological Summary, New York, N. Y., January, 1910.

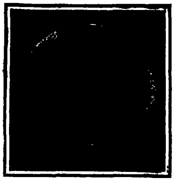
Atmospheric pressure Highest, 30 79, lowest 29 20, mean, 30 10 Temperature Highest 51, date 21st, lowest, 5, date, 5th, mean of warmest day 46, date, 21st, coolest day, 18, date 4th, mean of maximum for the month, 38 8, mean of minimum 26 0 absolute means 32 4, normal, 30 6, daily excess compared with the mean of 40 years, 1 8 Warmest mean temperature of January, 40, in 1880-1890, coldest mean, 23, in 1893 Absolute maximum and minimum of January for 40 years, 67 and 6 Average daily excess since January 1st 1 8 Precipitation 5 61 greatest in 24 hours, 1 58, date, 13th 14th, average for January for 40 years, 3 80 Accumulated excess since January 1st, 1 81 Greatest precipitation 6 15, in 1882, least, 1 15, in 1871 Wind Prevailing direction, northwest, total movement 9 163 miles average hourly velocity, 12 3, maximum velocity 56 miles per hour Weather Clear days, 7, partly cloudy 10, cloudy, 14, on which 0 01 or more of precipitation occurred, 14 Snowfall 18 6 Mean relative humidity 77 1 Sleet, 5th, 29th Dense fog 6th, 21st, 29th

The Argentine Exposition.

The centenary of the Argentine Republic is to be celebrated by an international agricultural exposition which is to take place this year The exposition is to be opened at Palermo (Buenos Ayres) on Friday June 3rd, 1910 and will close on Sunday July 31st 1910 The exposition will be divided into eight sections

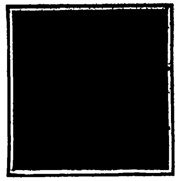
1 Geology, Hydrology, Climatology and Geography in relation to Agriculture 2 Machinery and Implements 3 Rural Engineering 4 Vegetable products 5 Animal products 7 Means of promoting agriculture 8 Special section for seeds

Entries and application for space may be written in Spanish French English, German or Italian, and should be addressed to the Secretario de la Exposición Internacional de Agricultura de 1910 Florida 316 Buenos Aires República Argentina These entries or applications for space must be made on the printed forms which the Secretariat of the Exhibition will furnish to all persons who may apply for them at the offices of the Rural Society at the address mentioned, or to the Argentine legations and consulates abroad Entries and applications abroad can be presented at the Argentine legations and consulates general on the same dates and under the same conditions as any others.



THE LOWE OBSERVATORY ON ECHO MOUNTAIN, CALIFORNIA. U. S. A

BY EDGAR LUCIEN LARKIN, DIRECTOR



Do you want to imagine that you can almost near the earth in its turning? No word printed on paper can convey to the mind of a reader this impressive silence above the clouds When Echo Mountain is within a heavy cloud the darkness is that of night From sunset until dawn when clouds are excessively dense the jet black solitude is indeed weird The mind is always profoundly impressed and imagination is vivid and alert In the midst of this quietude and darkness lights are suddenly turned on by a distant hand Night turns to day Huge masses of metals and wires in a dynamo in Los Angeles, in rapid revolution, cause the light to flash out on the mountain top The observatory is on a sharp peak between two immense canyons, deep and wide The mouths of these chasms cut in herculean rocks are blacker at midnight than the imagination can conceive.

Who knows the meaning of the word *clear*? None is able to understand what clear means if living in a valley Here on Echo Mountain the atmosphere is so clear that the stars seem near enough to touch, and the mountain air wonderfully pure The stellar hosts glow with a brilliancy all unknown to those living anywhere near sea level At all times, save immediately after copious rains the dust envelope surrounding the earth is visible beneath the summit of the mountain It covers the entire vista, even out to the sea To us on the mountain top it seems at times as if every human would choke in this layer of dust Above us at night, shine Sirius and Vega like huge diamonds, Arcturus and Spica likewise, and above all the giant star sun Canopus, glittering with amazing brilliancy in the distant south and flashing its rays over myriads of wave crests tossing in the Pacific Ocean This the brightest star in the celestial vault, cannot be seen from the latitude of New York The magnificent constellations of Orion, Hercules and the Polar Bear are so beautiful that words are powerless to describe them It is astonishing to behold the apparent nearness of the galaxy Mountain perspective the purity of the air and freedom from water vapor during two-thirds of the year combine to form an optical illusion At times this deceptive influence approaches a night mirage, and one seems to be walking among the very stars Here the witching hour is at sunset a sunset of orange and flower laden plains and watery wastes beyond Round and about the winter solstice the solar disk may be seen standing on the sea Soon half of the mighty sphere only is visible The last view is comparable to an arc light Then one by one the first magnitude stars are seen flashing between distant peaks. Before the last gleam of the sun has vanished, Aldebaran, Altair, Rigel and Procyon illumine the sky

Many gigantic sentinels, peaks, and summits lift their heads within a radius of a hundred miles of the peak These lie to the east to the north, and toward the sea in the west The effect is that of an amphitheater The south is open even down to the beach At sunset large steamers look small indeed when compared to the face of the adjacent sun Artists have journeyed to Echo Mountain to paint its sunset splendors to imitate nature on canvas. But brush and pencil are as impotent as words The view of clouds presented herewith is one of hundreds of thousands When the first rays of the rising sun strike such cloud banks as these, prismatic colors are seen that defy description—gorgeous oranges, carnations, and heliotropes beneath The effect is heightened by the singing of birds over the canyons As the sun rises above the horizon the blossoming plains below, the domes and spires of Los Angeles and Pasadena, surrounded by acres of roses, with beds of delicate wistarias, and rows of flaming red poinsettias, become visible. As the clouds are dispelled, miles after miles of trained cypress, pepper, orange, lemon, apricot, almond, walnut, prune, peach, pear, and nectarine trees, together with hundreds of long lanes, drives and roads adorned on both sides with tall, graceful eucalyptus trees, are seen

Carpet a floor with jet black velvet, and throw down upon it a myriad of diamonds in wild confusion, and perhaps you may conceive how the densely packed Milky Way appears from the observatory Millions is a word becoming astronomically obsolete; billions of stars is an expression much more nearly true of the Milky Way Billions of suns appear in the infinite deeps of the Galaxy These constitute the apparent cosmic floor, the base of Nature, and of the stellar structure. In hundreds of areas, there does not seem to be place for more stars. Millions are finer than the points of fine needles, and these make a pavement of starry sand I never really saw this sidereal base until with the telescope up here. After several days of rain, the atmosphere is swept clear of dust Then one is really within cosmic deeps when the telescope suddenly sweeps over fathomless interstellar chasms, doors or windows through which one apparently looks into the very bottom of space. These areas are absolutely black. No sensation within the entire range of stellar research, at the hour of a mountain midnight, is so completely overpowering as the vision of an abyss in the stellar floor Round and about these blackened wastes, there are cases where the stars are piled in heaps, raked into windrows, or strewn out into wisps, streamers, filaments, and spray Yet of all these stellar hosts the tiniest point may be a white hot sun, and larger than our little star—the sun

The giant nebula of Orion is a mass of starry lace, a fabric loaded with glittering points.

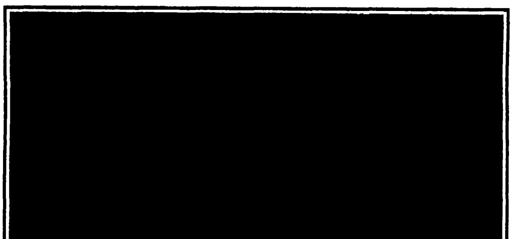
An astronomical telescope reverses all objects before it. The rotation of the earth is very apparent on Echo Mountain With high powers, the stars go racing across the field of view An incredibly startling effect is obtained when the telescope is set upon the Galaxy or Pleiades just as they rise out of some distant peak, or better, over the rim of the eastern canyon Then millions of stars seem to be pouring into the depths of the rock-hewn abyss descending low beneath the observatory. Floods of stellar points flow downward, as seen in the reversing eyepiece.

The observatory on Mount Lowe is 70 feet in length The peak had to be cut down to admit the foundations. The telescope is a fine Alvan Clark equatorial, with 16-inch objectives. A fine Brashear telespectroscope is here, and many other instruments.

An inclined electric-driven steel cable draws two cars from the deeps of Rubio Canyon to the summit of Echo Mountain The length of this railway is 3,000 feet, vertical ascent 1,325 feet, and time of ascent and descent 8 minutes The altitude of the observatory is 3,490 feet, and is 4 miles from Pasadena, 13 from Los Angeles, and 18 from the nearest shore line of the Pacific.

The railway from Los Angeles through Pasadena and Altadena lies in between orchards of orange trees. Golden fruit may be seen during five months of each year Almond trees in bloom and orange flowers and ripened fruit are objects eliciting the admiration of all.

This observatory was founded by the dean of living aviators, Prof Thaddeus S C Lowe, in 1894 Dr Lewis Swift was astronomer in charge until August 11th, 1900



Grand panorama from Echo Mountain. Looking due south from the Lowe Observatory

Land area is 900 square miles. The cloud is exactly over Pasadena. The observatory is shown in the foreground. Los Angeles is to the right of this view

THE LOWE OBSERVATORY ON ECHO MOUNTAIN, CALIFORNIA, U S. A.

A Kinematograph Rifle Target.

Among the novel uses for which animated photographs have been utilized, one of the most ingenious is that recently perfected by two English inventors, Messrs. J Paterson and J T Musgrave This is its application to rifle-fire practice, the idea being to render the eye of the marksman keener, and to enable him to be more expert in the quick handling of his arm

The "bioscope target," as it is called, is of very simple construction and operation. There are two rollers, upon which is wound a sheet of paper of any desired size, like the films of a camera, the clear space between the two rollers comprising the screen upon which the pictures are thrown The lantern is placed behind the marksmen in such a way that their movements do not interrupt or interfere with the projection Immediately behind this paper screen is a self recording target system, which instantaneously conveys the value of each shot to an indicator at the firing point. The value of these hits may be graduated as required Thus the maximum points corresponding to a bull's eye are given for a fatal shot, another value for inflicting upon the objective a mortal wound, another for temporary disablement, and so on. The indicator not only communicates the individual hit, but at the completion of the round, or practice, registers and gives the total value of hits made.

The range can be varied from 15 to 25 yards as desired The paper screen as it is destroyed by the bullet perforations is wound up on the second roller The self recording mechanism behind the screen is so arranged that it absolutely synchronizes with the movements of the object in the picture, at which aim is taken, so that there is no possible chance of a wrong value being given for an individual shot. The indicators are placed immediately above the marksman's head at the firing position, and a fatal hit can be signified by the ringing of a bell, as with the ordinary

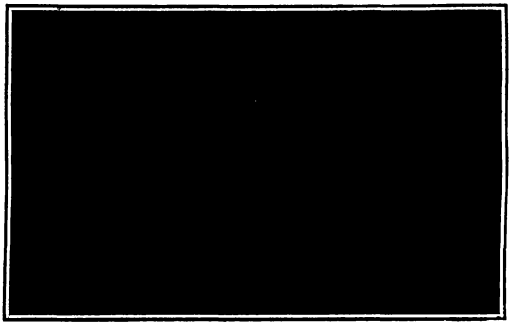
bull's eye target. The pictures, which have been specially prepared for use with this apparatus, are of such a character as to develop the celerity and certainty of the marksman's aim to the supreme degree. There is a scout scene, the enemy appearing on the picture first at a relative 100 yards range. He drops on his knee and fires point blank at the marksman a certain number of rounds, corresponding possibly to a complete charge of his rifle magazine. The marksman using the target raises his rifle immediately the kinematographic scout is seen, but does not commence firing until the scout opens fire, the appearance of a puff of smoke in the picture indicating the commencement of firing.

The scout then retreats at the double to a distance corresponding to 200 yards range, when the same cycle of operations is repeated. The scout then retires once more until he reaches a point corresponding to 500 yards range, and the same tactics are once more carried through. It will be seen that in each phase the target becomes decreased in size, according to the range, and at the maximum range offers a very small object to the marksman. Moreover, the fact that the latter has to discharge the whole of his rounds in the short period between the picture scout commencing and finishing firing at each distance, in order to score, indicates that aiming and firing must be accomplished very quickly. Yet it has been found that in the course of but little practice, the marksman can pick up the range and conform with the firing conditions so expertly that about ninety per cent of fatal shots can be got in with each round at the respective ranges.

The invention is also applicable to training in revolver shooting, and for this work an ingeniously suitable film has been prepared. It portrays a conflict with an armed housebreaker. The burglar effects his entrance through the window, under which in the room, a roll top desk is drawn at an angle. In the course of his work the burglar is disturbed, presumably by someone entering the apartment. He instantly shields himself behind the desk, exposing but his head and shoulders, and cocks his revolver. The burglar's disturber is represented by the marksman at the firing point, who at the psychological moment the burglar is about to fire, empties his revolver. In this act the burglar presents a fair-sized target, with his protruding head and shoulders at a few yards range. The burglar having emptied his arm turns to escape through the window, but in the act of dropping from the sill, to which he clings by one hand he raises his head, and drawing his revolver once more, fires. The marksman waits until he sees the burglar's head fully exposed and just about to fire, and then shoots. In this case, owing to the greater range and the small area offered by the man's head and shoulders in profile, the area offered to the marksman's aim is somewhat small. The burglar indicator represents in silhouette the head and shoulders of the burglar in the two firing positions, and the vulnerable points of this part of the anatomy are shown on the indicator, so that the firer can instantly determine whether he has struck the target in a fatal spot, has inflicted a mortal wound, or has either missed entirely or only inflicted a flesh wound.

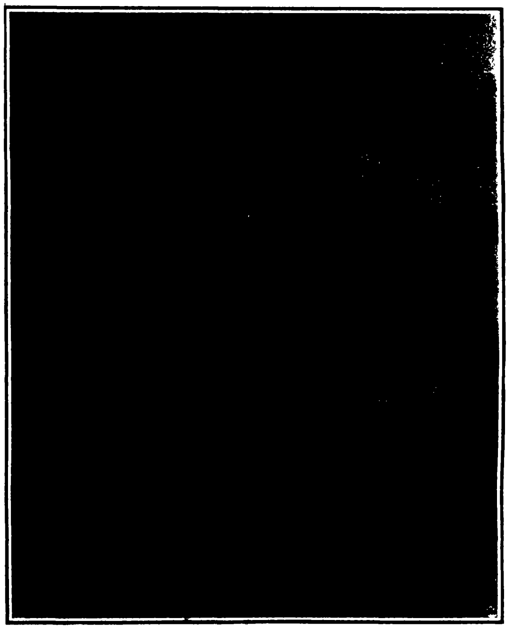
The projection is automatically controlled. The lantern is electrically driven by means of a small motor, and this is operated from the firing position by means of a small switch. The same picture can be projected time after time, there being automatic devices for winding and rewinding the spool preparatory to projection. Being electrically driven, a uniform projecting speed is secured, and as it is directly under the control of the marksman the apparatus is only set in action when required.

The idea can be developed to an indefinite extent, and the variety of pictures that can be used for improving the fire of the marksman is endless. It can be adapted for individual or company firing, and very realistic scenes can be pictorially produced. The application of the bioscope to this phase of military training has often been advocated and indeed attempted, but hitherto it has been found difficult to evolve a practical simple apparatus. The British War Office has investigated and subjected the invention to searching tests, and has ascertained that marksmanship can be so rapidly improved by this means that its general introduction into the service is being contemplated.



The cloud splendors of Echo Mountain south of the Lowe Observatory.

The clouds in this picture are about 1,000 feet below the building. Orange tree orchards are dimly seen in their shadows below.



This is not a volcano in eruption but a forest fire 8 miles west of the Lowe observatory, which fire started in La Canada Valley and traveled its way to the summit, burning for several days. Colossal flames and smoke looked like a volcano in action.

THE LOWE OBSERVATORY ON ECHO MOUNTAIN, CALIFORNIA, U. S. A.

A new method of bonding new concrete to old was described by Mr. Frank Barber, of Toronto, in a recent article in the Canadian Engineer. This consists in placing bags of cracked ice on the last surfaces of concrete placed at night, thus reducing the temperature of the concrete and, consequently, retarding its time of setting, so that on the next morning the surface is still plastic and the concrete then placed will set in one mass with the old. The invention of this scheme is credited to Mr. O. L. Hicks, when he was contractor for a reinforced concrete truss bridge in Ontario. As all of the members of these trusses were of relatively small cross section the ice bags were easily placed in position, at the end of a day's work and it is stated that the method worked very successfully. To what extent it could be applied to heavier work is not as yet known.

Hitherto dew has been used as a beverage only in poetry, by the sun, flowers, and butterflies. It has recently been robbed of all its poetic character by being used for the refreshment of English soldiers. The English administration at Gibraltar, where water is very scarce, now collects dew by the following very simple method. A large pit is dug in the earth and covered with dry wood or straw which, in turn, is covered either with earth or with sheet iron. The straw or wood serves as a heat insulator and effectually prevents the conduction of heat from the ground to the layer of earth or the sheet iron, above. Consequently this earth or iron cools after sunset much more rapidly than the ground, so that its temperature soon falls below the dew point of the surrounding air. Hence dew is formed upon the iron or the layer of earth in very large quantities. The water thus obtained is drained off into reservoirs and after clarification is used for drinking.

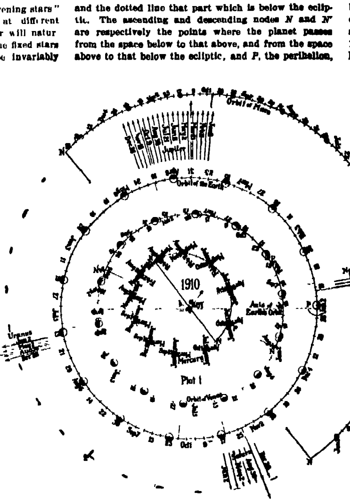
MORNING AND EVENING STARS FOR 1910

BY PROF. FREDERIC R. HONEY. TRINITY COLLEGE

The popular expression "morning and evening stars" while signifying those planets which at different periods illuminate our skies, the observer will naturally include in his study of the heavens the fixed stars whose name indicates that they will be invariably found in the same places on the celestial sphere. Their positions in the heavens may be sooner fixed in the memory by first observing the stars of higher magnitude whose conspicuous brightness easily distinguishes them from those of varying degrees of lesser brilliancy. In this way the heavens may be triangulated visually, and in process of time all the constellations may be easily identified. For such observations a star map is indispensable, and the positions of the stars should be located by right ascensions and declinations, which are given in the Nautical Almanac. The position of the celestial equator from which declinations are measured may be determined approximately by observing the stars which are near it on the star map, and in the same way the position of the first meridian intersecting the celestial equator at a point from which right ascensions are measured, may also be defined. Following this method seven-eighths of the celestial sphere (at latitude 40 deg.) will come within the range of vision, and the heavens may become an "open book." The distances to the fixed stars are so great that (except to the astronomer) their apparent positions are not disturbed when the earth reaches the opposite point in its orbit—a distance equal to about one hundred eighty-six million miles. For purposes of observation the earth may therefore be regarded as the center of the celestial sphere around which the stars appear to revolve once in a sidereal day, which is nearly four minutes shorter than an ordinary day, a difference due to the revolution of the earth around the sun once in 365¼ days. During this period the earth makes 366¼ rotations on its axis. As a consequence the stars rise nearly four minutes earlier every day, and during the year the major part of the celestial sphere comes within the range of vision at any assigned hour of the twenty-four. The positions of the planets are continually changing, and in order to discover the region of the heavens in which to search for them their situation relative to the sun and earth should be determined as illustrated in Plots 1 and 2. The plots of their orbits have been printed in the SCIENTIFIC AMERICAN in the issues of the following dates: March 17th, 1906, February 9th, 1907, February 15th, 1908, and March 6th, 1909, and the positions of all the planets are shown for every day of each year. Together they exhibit the courses of all the planets for the five consecutive years from 1906 to 1910 inclusive. The orbits of the asteroids which are between those of Mars and Jupiter, Saturn, Uranus, and Neptune, are too small to be visible to the naked eye, the largest of over six hundred being not more than five hundred miles in diameter. Several of the orbits are very eccentric and inclined at large angles to the plane of the ecliptic.

THE SUN AND PLANETS

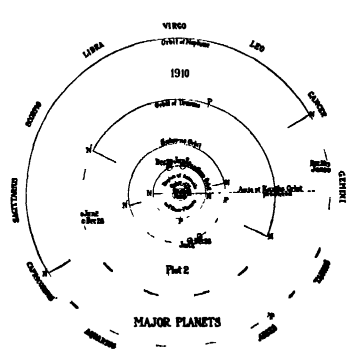
In order to bring the plots of the orbits of the planets within the limits of this page, the orbits of the terrestrial planets, which include Mercury, Venus, the earth, and Mars, are drawn to as large a scale as the space permits. Since the diameter of Neptune's orbit is thirty times that of the earth, the plot of the orbits of the major planets, including Jupiter, Saturn, Uranus and Neptune, are drawn to a scale which is very much reduced. In this plot the orbits of the earth and Mars are repeated by the reduced scale, the region of the asteroids or minor planets is indicated, and the plots together show the continuity of the solar system. The plane of this paper may be taken to represent that of the ecliptic or the earth's orbit, and if it be placed in a horizontal position a planet which is on one side may be described as being situated above, and on the other side as below the ecliptic. In the plot of each orbit the full line represents that part which is above, and the dotted line that part which is below the ecliptic. The ascending and descending nodes N and N' are respectively the points where the planet passes from the space below to that above, and from the space above to that below the ecliptic, and P, the perihelion,



PLOT I. POSITIONS OF THE PLANETS.

is the point of the planet's nearest approach to the sun. A line joining the points N and N', the line of nodes, is the intersection of the plane of the planet's orbit with that of the ecliptic. To avoid confusion, only a portion of this line is represented, except in the case of Mercury's orbit.

It is obviously impossible to represent the diameter of the planets by the same scale. Even those of the giant planets Jupiter and Saturn would shrink to mere points. The same may be said of the sun itself in Plot



PLOT II.—PLANETARY ORBITS.

2, but in Plot 1 its diameter (866,400 miles) would be correctly represented by a measurement a little more than one-half of e, which is the linear eccentricity—the distance from the sun's center to the center of the earth's orbit.

THE EARTH

The earth's mean distance from the sun (92.9 million miles) is diminished by a little over one and one-half million miles at perihelion in January; and increased by the same distance at aphelion in July. The center of the orbit is at e. At a velocity of 18.5 miles per second the earth moves each day on the average nearly 1,600,000 miles, with an increase of velocity at perihelion and diminution at aphelion; making the complete revolution in 365¼ days. The position of the earth is shown at intervals of four days at Greenwich, noon, and intermediate positions and dates may be interpolated by subdivision.

MERCURY

The plane of Mercury's orbit is inclined at a greater angle (7 deg.) than that of any other of either the terrestrial or major planets. Its eccentricity is also greater than that of any of the planets. By the eccentricity is meant the distance from the center of the orbit to the sun (the linear eccentricity) divided by the semi-major axis. The linear eccentricity is 7.4 million miles, and the length of the major axis is 72 million miles. Mercury's mean distance from the sun is therefore thirty-six million miles with a diminution and increase of 7.4 million miles respectively at perihelion and aphelion. At perihelion the planet moves at a velocity of thirty-five miles a second, which is diminished to twenty-three miles a second at aphelion. Mercury's orbit is a marked illustration of the first two of Kepler's three laws. First: The orbit of each planet is an ellipse, with the sun in one of its foci. Second: The radius vector (i. e., the orbit radius whose length is continually changing) of each planet describes equal areas in equal times. For example, the area of the triangle with the sun as its vertex, and with a base equal to that part of the orbit included between the dates of August 30th and September 7th, is equal to the area of the triangle with the same vertex and for a base that part included between the dates October 9th and October 17th. In conformity with the second law, the length of the base of the triangle is continually diminishing from perihelion to aphelion, and increasing from aphelion to perihelion, which accounts for the rapid variation in the planet's velocity. Mercury's revolution around the sun is accomplished in very nearly eighty-eight days (87.97). This is repeated over four times during the year, and four dates are attached to each position. Owing to the great variation in the planet's velocity the positions are shown for every second day.

VENUS

The orbit of Venus is inclined to the plane of the ecliptic at an angle of 3.4 deg. The eccentricity is less than that of any other planet, and is barely visible in the plot, the distance from the sun to the center of the orbit is less than a half a million miles. As a consequence, the velocity of the planet in its orbit at a mean distance of 67.2 million miles is nearly uniform at the rate of 21.9 miles per second. The period of revolution is 224.7 days. The dates outside the orbit are those which belong to the first revolution, those within, to the second revolution, and that part of the orbit included between the positions of the planet for the first and second revolutions represents the distance traversed in seven-tenths of a day.

MARS

The orbit of Mars is inclined at an angle of 1.85 deg.; and the center c is 13.2 million miles from the sun. The mean orbit velocity is fifteen miles per second, and the mean distance from the sun is 141.5 million miles. The period is 1.88 years.

THE MAJOR PLANETS.

The inclination of Jupiter's orbit is 1.3 deg., with a linear eccentricity of 22.3 million miles. The planet's orbit velocity is 8.1 miles per second at a mean distance of 483.3 million miles. The period of revolution is 11.86 years. The direction in which the planet is seen from the sun is shown at intervals of twenty days.

Saturn's orbit is inclined at an angle of 2.5 deg. The eccentricity is nearly fifty million miles; and the mean distance is 886 million miles. The planet's velo-

(Concluded on page 155.)

CURIOSITIES OF SCIENCE AND INVENTION

A STREET RAILWAY AUTOMOBILE.

A steam automobile street railway has recently been installed for regular passenger service between Mandeville and New Orleans, La. The cars are each fitted with a 30-horse-power steam engine and generator, making them practically automobiles on rails. The line is 16 miles long, and steam motive power has been installed in order to reduce the cost of maintenance. Two street automobile cars built as an experiment have proven so successful that more are now under construction Each car is built to seat twenty-two people, and the expense of maintaining the line under present power permits of a large saving over the ordinary electric street railway maintenance.

A STREET RAILWAY AUTOMOBILE

GALILEO'S TELESCOPE.

Just about three hundred years ago, Galileo exhibited a telescope which he had used in studying the moon and planets. This was not the first telescope ever built, but it was however the first telescope to be used for astronomical purposes. The accompanying engraving shows how the telescope looked. This type of telescope differs from the present astronomical type in using a concave instead of a convex eyepiece, so that by a combination of but two lenses, the object glass and eyepiece, he was able to view objects right side up, whereas in the present astronomical telescopes objects are inverted The Galilean type of telescope is now used in the ordinary opera glasses With this crude instrument Galileo was able to establish the fact that the moon is a round body with its surface broken by mountains, that the Milky Way is composed of countless stars, that Venus and Mercury have phases like the moon, and that Jupiter has a number of satellites (four were discovered by Galileo) To him Saturn appeared to be a triple planet. This puzzling phenomenon was explained fifty years later by Huygens, who discovered that the planet was surrounded by a flat ring

THE FIRST ASTRONOMICAL TELESCOPE.

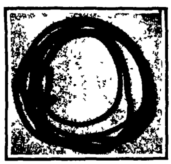
AN EGG WITH A TAIL.

Occasionally, for one reason or another, a hen will lay a "soft-shelled" egg, but one with a tail, like that shown in the accompanying photograph, is decidedly unusual This egg was evidently the last of a clutch, and, though the hen lacked material for a shell, she had a surplus for the shell lining, or egg pod.

AN EGG WITH A TAIL.

A FROZEN TELEPHONE CABLE

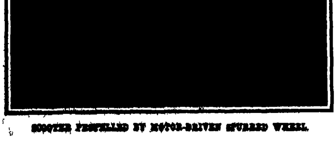
The accompanying photograph shows the effect of ice pressure on a twenty five pair lead telephone cable The cable was located in a three-inch iron pipe, and was run underground for fifty feet between the terminal pole and the manhole in the street Owing to a fault in the construction of the lateral, the pipe did not drain into the manhole, which allowed water to collect in the pipe for a distance of about twenty feet. Last winter being an extremely cold one caused this water to freeze in the pipe, the pressure crushing the cable out flat. In several places there was a quantity of small stones and gravel in the iron pipe and so strong was the pressure of the ice in the pipe that these stones were forced into the armor of the cable as though driven in by a hammer The wires had the usual paper insulation, and the extreme pressure forced the wire through the paper at every twist of the conductor The cable was dented and crushed for a distance of twenty feet.



THE EFFECT OF ICE ON A TELEPHONE CABLE

MOTOR SCOOTERING.

Some years ago an amphibious craft was invented at Great South Bay Long Island which could be maneuvered on ice as well as in the water It was in reality an iceboat provided with a flat-bottomed hull which would float the craft in case of encountering a blowhole or break in the ice The sport proved to be very fascinating, particularly the peculiar sensation of plunging off the ice into the water and then climbing back again The "scooter," as this craft is named, is now undergoing further development. Instead of depending upon the sail for power, Mr Nat Roe of Patchogue, L. I., has equipped his scooter with a 30-horse-power motor and a spurred wheel, which digs into the ice and drives the craft along He claims to have traveled over the ice at a rate of 90 miles per hour There is no means for propelling the boat while in the water, but the sport consists in leaping gaps in the ice by the sheer momentum of the craft He has leaped gaps of over a hundred feet in this way The motor scooter possesses an advantage over the motor sled, because it cannot sink in case of breaking through the ice, and over the sail scooter in the fact that under its own power it can be taken home over snow-covered roads when the owner grows tired of the sport



SCOOTER PROPELLED BY MOTOR-DRIVEN SPURRED WHEEL.

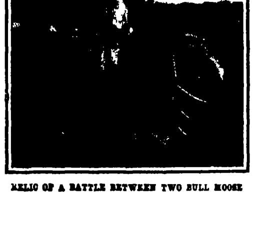
LARGEST PROJECTILE IN THE WORLD

The accompanying illustration is of more than ordinary interest from the fact that it shows the largest and heaviest projectile in the world being the huge 5-foot, armor piercing shell fired from the United States government's great 16-inch rifle This giant shell and powerful gun are considered two of the most destructive and deadly engines of warfare in existence The monster 16-inch rifle the only one built so far is now at the Sandy Hook Proving Grounds, and has only been fired a few times The huge shell of steel can be hurled a distance of 20 miles or more and weighs 2 100 pounds The powder charge is nearly 500 pounds The cost of firing one shot reaches in the neighborhood of $1 000 It is not probable that this type of gun will be used but rather the 14-inch for the main coast defenses of the Panama Canal and possibly the Philippines This formidable and long range weapon though capable of firing so tremendous a projectile is too costly and fires too slowly for modern warfare

LARGEST PROJECTILE IN THE WORLD

INTERLOCKED MOOSE ANTLERS

A curious relic of a fatal battle between two bull moose is shown in the accompanying illustration The battle was fought in the Kenai Peninsula Alaska a few years ago An Indian was attracted to the spot by the noise of the encounter, and on nearing the two antagonists he found that one had broken its neck during the struggle and lay dead on the ground while the other partly exhausted was making desperate efforts to free his horns After killing the latter moose the Indian tried in every way to separate the antlers but found this to be impossible The interlocked antlers are soon to be exhibited in the collection of heads and horns in the new Administration Building of the New York Zoological Park The larger pair of horns has a spread of 69½ inches and the other of 62 inches



RELIC OF A BATTLE BETWEEN TWO BULL MOOSE

THE DESIGN FOR THE NEW QUEBEC BRIDGE

COMMONPLACE IN APPEARANCE AND COSTLY TO BUILD

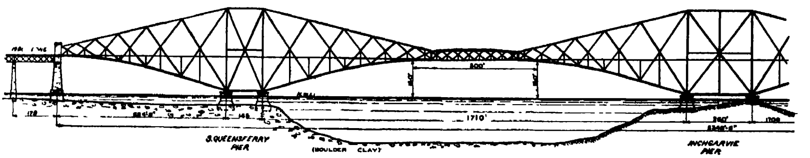
The collapse of the huge cantilever bridge at Quebec on August 29th 1907, was at once the greatest and most fatal catastrophe in all the history of bridge construction ancient or modern When that colossal structure broke down under its own weight and disappeared from sight in the St Lawrence River more than eighty human lives and many millions of dollars were lost in the space of a few brief minutes. Naturally the disaster caused a great loss of prestige to the engineers who were connected with the work, and discredited bridge engineering as carried on in the Western Hemisphere before the eyes of the whole world The great prominence of this bridge was due to the fact that it embodied the longest span (1,800 feet) yet attempted This was longer by 90 feet than either of the two large spans (1 710 feet) of the great Forth Bridge in Scotland, which is at present the largest bridge in existence

An investigation of the facts by a Royal Commission revealed as the cause of the collapse faulty design of the compression members It was ascertained that the slightest attempt to combine the beautiful with the useful The faulty structure which collapsed had at least the redeeming feature that the outlines were structurally and æsthetically correct, and although the Forth Bridge has been made the subject of much criticism by the artist and the architect, it must be regarded as having distinct claims to beauty when compared as on the accompanying page, with the new plans for the Quebec Bridge

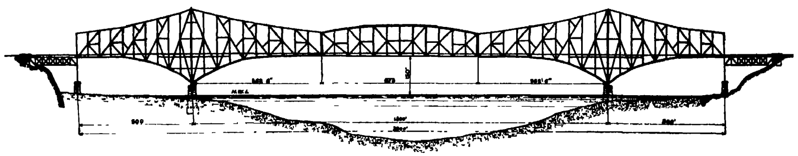
It would seem, however that the Board has some doubts as to the merits of its own work, for it now invites competitive plans from contractors which are to be filed by May 1st, 1910, the plans to be drawn at the contractor's own expense But if the Board has taken eighteen months' time and spent $150,000 to produce the present plans, the public will naturally ask, How can the Board expect responsible firms to furnish them with new plans in one-sixth the time and for nothing?

The lay of the land at the Quebec crossing is such as to make it almost certain that a thoroughly rigid pressure during high gales, and particularly is this provision necessary to insure safety during erection. The bridge which failed was only 67 feet wide, and this small width was a large contributing cause to the twisting of the structure during erection, which preceded its collapse This important fact does not seem to have been given sufficient consideration, for the new structure has a width of only 88 feet, or one-twentieth of the proposed length of span of 1,758 feet, as against one-fourteenth in the Forth Bridge

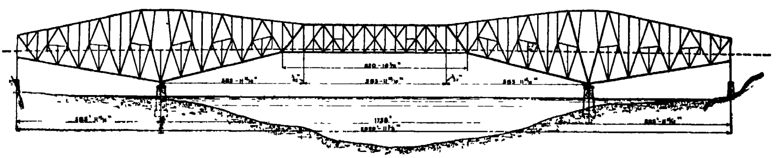
It may be claimed that experience with American practice in cantilever railroad bridges has shown a proportion of 1 to 20 to be sufficient, but it is a question how far their immunity from disaster during erection was due to the fortunate circumstance that no strong winds were experienced—such as frequently occur at the Forth Bridge, and may occur at Quebec —which would have twisted its trusses out of shape before they had been connected up Moreover, we believe it is a fact that there is not a large cantilever railroad bridge on this continent over which trains



One-half of the cantilever bridge, Firth of Forth, Scotland; completed 1890.



The Quebec bridge which collapsed August 29th 1907.



The unsightly structure now proposed by the Canadian government for the Quebec bridge.

THE DESIGN FOR THE NEW QUEBEC BRIDGE

management of the work was so badly organized, that the blame could not be definitely fixed in any one quarter, and in the end the Canadian government had to assume the whole money loss The work was eventually taken over by that government, and it was decided to rebuild the structure For this purpose a commission of three engineers was appointed, and it was publicly announced that the new bridge would be the finest and strongest structure of the kind ever seen

The Commission was appointed about eighteen months ago In the interim the preparation of the plans has cost about $150 000, and as the result of its eighteen months work the Commission has produced the very commonplace design, herewith illustrated, regarding which there is a general professional opinion that both structurally and æsthetically it is distinctly inferior to the Forth Bridge, which was completed nearly twenty years ago

If the bridge is built according to the proposed plans, it will not only be of inferior merit, considered from the bridge engineer's standpoint, but will also be the ugliest bridge of monumental proportions among those hitherto proposed or built. It presents the appearance of a monotonous mesh of triangles and straight lines From abutment to abutment there is not one graceful line in the whole structure, not the suspension bridge could be built more cheaply, more quickly and with less risk of failure during erection On the other hand, if a bridge of the cantilever type is selected, it should be one of the first duties of the Board to see that one of the contributory causes to the weakness of the bridge that failed, namely, its extremely narrow width, is removed But, so far from doing this the authorities have not only prescribed certain limitations of width, but they have actually contracted for the new stone piers upon this restricted basis, and it is a fact that the width is such as would put a serious limit upon any bridge engineer who attempted to design either a cantilever or suspension bridge with the necessary cross-sectional width to give the proper rigidity during erection, and subsequently when express trains are crossing the structure, Those of us who knew the late Sir Benjamin Baker, the builder of the Forth Bridge, and were familiar with his cautious methods, will agree that, could he have been consulted, it is more than probable that he would have disapproved of the present design, as he would surely have condemned the old one had it been submitted to him In his Forth Bridge the width at the base of the towers is 120 feet for a span of 1,700 feet which gives a ratio of 1 to 14 This large width at the towers is necessary to insure the stability and lateral rigidity of the entire structure under wind dare run faster than 25 miles an hour The vibrations, due to the narrow width, would become excessive, and at faster speeds would create danger of derailment. On the other hand, the advantages of great width in proportion to length are shown by the fact that the fast and heavy express trains in the north of Scotland pass continually and with absolute safety over the Forth Bridge at their full speed of from 50 to 60 miles an hour

Another element in the specifications upon which bids are invited which is puzzling engineers and contractors is that the maximum height of the towers has been limited to 290 feet above the masonry It really would seem as though the board of engineers who drew up the specifications were desirous to put weight into the new bridge merely for the sake of having it there, for it is well understood that the stresses in the top and bottom members of a truss, and therefore the amount of steel necessary to meet these stresses, increase inversely as the depth, and hence the shallower the bridge, the greater will be its weight In view of these facts, it is extraordinary that in the specifications the maximum height of the towers above the masonry should be limited to 290 feet. This height in the Forth Bridge is 330 feet, and in the Quebec Bridge which fell it was 315 feet. The

(Continued on page 154.)

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

CATTLE-STANCHION.—M. MURPHY, Grand Marais, Minn. This improvement allows the cow great freedom of movement, and no possibility of freeing herself from it, as the hook-like spur on the ring which locks the stanchion bar to the rod precludes her from so doing. At the same time the inventor provides for loosely joining the bar at both ends to the upright rod so it can swing freely about the rod without becoming detached.

Of General Interest.

CRATE.—H. H. CUMMINS, Cadillac, Mich. This crate has a bottom, side walls, end walls and corner posts, each post constructed of sections arranged side by side and having abutting faces, with one of the sections of each post secured to the side walls and the other section of each post secured to the end walls, and bolts or other equivalent devices securing the sections of each post together.

SHOW WINDOW GUTTER AND FLUSHING.—H. H. TRAFFER, Davenport, Iowa. The aim of this invention is to provide a gutter which may be disposed under the glass front of the window, and which is adapted to carry away all liquids resulting from condensation and otherwise. Ventilators are provided to maintain a proper temperature within the window inclosure and thus prevent condensation of moisture contained in the air.

METAL STAIRCASE.—J. F. STRIBER, New York, N. Y. The improvement refers especially to the means for attaching the treads of the stairs to the staircase or stringers, the object being to provide a simple arrangement for this purpose, and in which no fastening devices passing through the treads are required. The treads are expected to be made of stone, cement or similar material.

PLUNGER LUBRICATING RING.—H. ROTH, New York, N. Y. This invention relates to a device adapted to keep the plunger of an elevator lubricated in an efficient and thorough manner. It provides means whereby an elevator plunger may be kept thoroughly lubricated by a plurality of lubricating substances, in a simple and efficient manner.

DISPLAY STAND.—E. T. PALMENBERG, New York, N. Y. The object here is to provide a stand for use in stores and other places, and more especially designed for displaying belts and like articles to permit convenient selection by a customer as to style and size, the belts or other articles being securely held in place against abstraction by unauthorized persons, and at the same time to permit a salesman to readily remove any belt selected by a customer.

PIANO ACTION.—F. B. LONG, Los Angeles, Cal. To render the action noiseless, the hammer rail, key board, key or other member of the action is provided on one face with a recess into which is fitted and secured a piece of cork projecting beyond the face of the member, and in the case of the hammer rail or key frame a strip of felt is secured to the rail and the frame, to overlie the projecting portion of the piece of cork.

TURPENTINE-STILL.—B. HART, Jacksonville, Fla. In the present patent the invention consists of an improvement in turpentine stills and particularly in means for purifying the gum, etc., by straining the same to avoid the deleterious effect of wood, bark and other impurities being permitted to remain in the still.

Hardware.

SCISSORS AND SHEARS.—A. K. CHAPIN, Bristol, Conn. In this invention the blades can quickly be adjusted by the employment of a spring device on the pivot, to produce the necessary tension between the blades, and thus bring the cutting edges into correct cutting or shearing position, the arrangement being such that the parts of the spring device are locked in the adjusted position, thus preventing the parts from gradually working loose and hence insuring proper working of the shears or scissors at all times.

Household Utilities.

ADJUSTABLE WARDROBE-BED.—R. E. CARLTON, Latonia, Ky. The purpose in this case is to provide a folding bed especially adopted for the use of persons suffering with phthisis, and so arranged as to permit them to breathe the outer air while the body is protected within the house. The bed may be adjusted to any height of window, and to any reasonable size of window opening.

REFRIGERATOR.—L. DORAN, Port Arthur, Ontario, Canada. This refrigerator is adapted to be cooled by a cooling liquid rather than by the employment of ice, the construction being such that the liquid is distributed over an evaporating surface and air is caused to circulate over the surface to evaporate a portion of the water and thus lower its temperature.

Machines and Mechanical Devices.

STONE-CRUSHING MACHINE.—I. L. MITCHELL, Cedar Rapids, Iowa. This invention is an improvement in that class of ore and stone crushers in which a stationary jaw and movable jaw are arranged opposite each other and the latter is operated by an eccentric to impart a compound movement. It is an improvement in the means for adjusting the movable jaw toward and from the fixed jaw, as required to vary the size of the product.

CRUSHING-MACHINE.—I. L. MITCHELL, Cedar Rapids, Iowa. This invention is an improvement in machines in which a movable jaw is arranged opposite a fixed jaw, the two being so placed as to form a hopper or wedge-shape receptacle for the material to be crushed. The movable jaw may be adjusted for crushing finer or coarser. Mr. Mitchell has also invented an improvement in that type of coal, ore and stone-crushing machines in which a movable jaw is pendent from and operated by an eccentric shaft, and arranged opposite a fixed jaw so that they form practically a V-shape hopper for reception of material to be crushed.

REVERSING MECHANISM.—J. R. GOLTER, Greensboro, N. C. In operation the washing machine is provided with a revolving washer and with gearing at its opposite ends for turning the washer, the gearing being operated alternately to turn the washer in opposite directions so that the strain of turning the washer in one direction is borne at one end of the machine, and the strain of turning it in the other direction will be borne by the opposite end of the machine.

PAPER AND PAPER HANGER.—W. P. CRONK, Burwell, Neb. One object of the invention is to provide a device in which both the paste and the paper may be held and by which the paper may be pasted by the simple act of drawing it out of the machine. Another object is to provide means for cutting off the paper at the proper length.

THREAD-HOLDER.—J. ROSENBERG, New York, N. Y. The invention is an improvement in holders of the character disclosed in Letters Patent formerly granted to Mr. Rosenberg. The purpose is to simplify and generally improve the locking mechanism, which he does by providing a single bolt for each pair of oppositely disposed arms, the bolts being endwise movable in either direction to alternately engage and disengage the pins.

DETACHABLE PROPELLING MECHANISM.—J. F. LASKO, Chicago, Ill. Generally speaking, the invention consists in a screw propeller operated from the source of power through a suitable train of gears, which is adjustably attached to the stern of a boat by suitable clamps and which is provided with suitable means to ship the propeller so that it will act at various angles to steer the boat.

BARREL-FORMING MACHINE.—E. P. EVERETT and G. W. NORTON, New York, N. Y. The intention of the invention is to provide a machine having rollers of special form, particularly adapting them for forming the bilge or curvature, and the rolls are constructed and arranged in such a way that the velocity of the faces of the rolls on the opposite sides of the web at any particular point is the same.

ANTIRATTLING DEVICE FOR BRAKE-BANDS.—J. EVANS, Utica, N. Y. The invention pertains to brake mechanism such as is used on automobiles and other machines. The aim is to provide a device for preventing rattling of the brake band while the machine is running and the brake band is not in use, the device not interfering with the application of the brake whenever it is desired to do so.

ANIMAL-TRAP.—A. MARCUAND, Bridgeport, Wash. A main object here is to provide a platform in which the main section is hinged adjacent to the open end of the chamber and in which the trigger section is also hinged at the edge thereof toward the open end of the chamber, so that the animal in traveling into the chamber will encounter no obstacle in passing from the main section to the trigger section.

Prime Movers and Their Accessories.

VAPORIZER HEATING DEVICE.—A. E. OSBORN, New York, N. Y. This device increases ease of starting internal combustion engines, and is of especial interest, as the fuels used are tending to become heavier and harder to vaporize. The principle employed is the utilization in several ways of part of the heat of a lamp that lights the vehicles' path so that the first charges drawn into the engine will have enough heat to get a good mixture, after which the heat from the engine's operation would take care of vaporization. As the greatest difficulty in starting is at night when lamps are lit anyway, no additional trouble or expense is caused when the device is fitted to the vehicle. In fact, a saving is due to its use, for with certainty of easily starting the engine, there would be no running during stops.

GAS-ENGINE.—G. DOERFEL, Fruitvale, Cal. The invention relates to gas or internal combustion engines. One object is to provide means whereby a gas engine of considerable power may be constructed to occupy a comparatively small space, and one in which the cylinders are located radially about the main or driving shaft.

DREDGING APPARATUS.—J. OSTERVOLD, Westport, Ore. An object of the invention is to provide an apparatus for use in removing sandbars, shoals and the like in rivers, harbors and water-ways, which require little power for its operation, and which can be adjusted for use with shoals or other obstructions of different sizes.

Railways and Their Accessories.

TRACK-SANDING APPLIANCE.—F. G. SCHWARTZ, Colorado City, Colo. The invention embodies an auxiliary sand feed receptacle, having discharge openings at either side and a sand supply pipe extending thereinto and terminating above the bottom of the receptacle at or near the level of the openings, whereby the sand is automatically cut off when it is piled up in the receptacle to the bottom of the pipe, leaving the discharge openings free for the delivery of the sand, and air injector nozzles extending into the receptacle and directed to blow the sand through the openings.

Pertaining to Vehicles.

TIRE ARMOR.—C. G. WRIGHT, Greensboro, N. C. The armor disclosed in this patent consists of a metallic band extending around the tire in the groove in the tread. The armor band is provided with suitable spurs and is held in place by straps that extend in transverse grooves in the tire. The ends of the straps inside are bolted to the rim or otherwise suitably secured.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

KRITIK DER ERFAHRUNG VOM LEBEN. By Justus Gaule, Professor of Physiology in Zurich. Leipzig: Verlag von S. Hirzel, 1906. Two volumes, bound in paper. Price, $1.50 per volume.

The author informs us that this book is the result of twenty-five years of earnest study. In that study he has had in mind the clarification of problems which seemed obscure to him in our conception of reality. He has divided his book into two parts—analysis and synthesis. In the first volume on analysis he discusses theories of the structure of living creatures as unearthed by scientific investigation. It is the purpose of synthesis to reconstruct the desired phenomena from the unities thus obtained. The book differs from most German scientific and biological works because of its simple and even graceful style. There is nothing of that involved Teutonic construction which usually makes German scientific works all but unreadable. Our limited space prevents us from giving more than the chapter headings. The first volume is divided into "general analysis and special analysis." Under "general analysis" the author sets forth why a critique of biological experience is necessary. Under special analysis he enumerates the arguments upon which a critique of biological experience must rest. In the volume on synthesis he discusses the structure of living things, symbiosis, hyphoid and zooid, manifestations of life, reproduction, vertebrate organisms, functions of centralization.

EFFICIENCY AS A BASIS FOR OPERATION AND WAGES. By Harrington Emerson. New York: The Engineering Magazine. Pp. 171.

Mr. Emerson is a member of a new profession, viz., the directing of the great forces of manufacturing to the best advantage. He is what is called an "efficiency engineer," which in the vernacular means a doctor for a sick business. In this little book he has laid down the leading principles of this new profession and set forth very clearly the necessity of efficiency engineering to get the most out of men and machines and to cut down waste. Mr. Emerson's main argument seems to be that works management should be essentially military. It must have both line and staff. The line is the general administrative force, which reproduces itself automatically because promotion is by seniority, as in the army. The staff, on the other hand, is composed of men picked out for their peculiar qualifications regardless of age. Just as the youngest captain in the army may be an authority on aeroplanes and their military use, so the youngest man in a machine shop may be an authority on the electric drive. Mr. Emerson's methods have already found application in some of the largest manufacturing and operating institutions in the United States and have justified his criticisms of the extravagant management of railroads and large industrial works. Particularly valuable are his chapters on the realization of standards in practice and the modern theory of cost accounting. As a piece of writing this book may be regarded as a model of forceful and terse English. The author is evidently a man of wide reading, for he is able to illustrate his point with many an apt historical allusion which adds zest to his remarks and makes his book most readable.

THE STORY OF THE COMETS SIMPLY TOLD FOR GENERAL READERS. By George F. Chambers, F.R.A.S. Oxford: The Clarendon Press, 1909. 8vo., pp. 256.

The return of Halley's comet lends to this book a timely interest. The author has collected here all that is worth while knowing about comets in general and presented his information in a fairly popular style. This book seems to be in every way up to date, for we find in it comments upon Morehouse's comet of 1908, and upon the vagaries of that singular body. More perhaps might have been made of the radiation pressure theory of tail formation, but since the theory is mentioned a criticism on this point might seem captious. After some general remarks on comets, in which their general nature is discussed, the author passes to a physical description of comets. An excellent chapter is that on the tails of comets. In the chapter on movements of comets the author discusses the periodic and non-periodic comets, together with comet masses and the possibility of collision between the earth and a comet, Jupiter's family of comets, etc. The discovery and identification of comets constitutes the subject matter of still another chapter. Other interesting chapters are those on periodic comets of short periods, lost comets, periodic comets of long periods, Halley's Comet, remarkable comets, the orbits of comets, comets in the spectroscope, the relation of comets to meteors, comets in history and poetry, and cometary statistics. The author has supplied some excellent appendices, including a catalogue of recent comets, and has given a good bibliography and ephemeris of Halley's comet from January to July, 1910.

A MANUAL OF FORENSIC CHEMISTRY. Dealing especially with Chemical Evidence, Its Preparation and Adduction, based upon a course of lectures delivered at University College, University of London. By William Jago, Fellow of the Institute of Chemistry, Fellow of Chemical Society, of Lincoln's Inn, Barrister-at-Law. London: Stevens & Haynes, Bell Yard, Temple Bar, 1909. Pp. 256.

This book is a republication of a series of lectures delivered by the author to the students of University College, London. The lectures were delivered primarily for the assistance of the chemist, and the lawyer in the preparation and adduction of chemical evidence, the lecturer's aim being to get the members of the two professions information for their mutual methods and requirements. With this object in view, the author discusses the nature of chemistry and particularly of forensic chemistry and the range of chemical evidence, the adulteration of food, under the British Food and Drugs Acts, the adulteration of drugs under the British Act, the use or non-use of new manufacturing processes, the use of preservatives and coloring matters, criminal matters, chemical evidence in civil actions and committees.

THE WONDERS OF MECHANICAL INGENUITY. By Archibald Williams. Philadelphia: J. B. Lippincott Company, 1910. 8vo., 160 pp. Price, 75 cents.

The present volume is one of Lippincott's Wonder Series and deals in an interesting way with delicate instruments, calculating machines, workshop machinery, portable tools, oil and gas engines, motor boats, etc.

PRESBREY'S NATIONAL GUIDE FOR TRANSATLANTIC TRAVELERS. New York: Frank Presbrey Company, 1909. 18mo., 128 pp. Price, 25 cents.

This little volume contains a vast amount of information relative to the sea in compact form. It should be in the hands of all ocean travelers. Its use, however, is not limited to the sea, and a copy for reference should be found in every well-regulated library. It is filled with statistical information, plans of the principal ports of call, information as to navigation, etc. No pains have been spared to make this publication an accurate and reliable compendium for the tourist.

THE WONDERS OF THE PLANT WORLD. By G. F. Scott Elliott, M.A., B.Sc., F.L.S., F.R.G.S., etc. Philadelphia: Lippincott Company, 1910. 12mo., 155 pp. Price, 75 cents.

The titles of the chapters of this book are as follows: The Activity of Vegetables; On Savages, Doctors and Plants; A Tree's Perilous Life; On Forests; Flowers; On Underground Life; High Mountains; Arctic Snows; Scrub; On Tea, Coffee, Chocolate, and Tobacco; On Deserts; The Story of the Fields. Many of them are of entrancing interest. One of the interesting bits which we glean from it are that there are 173,706 species of plants, namely, 105,231 flowering plants, 2,819 ferns, 565 horsetails and club mosses, 4,609 mosses, 3,041 liverworts, 5,600 lichens, 39,603 fungi and 12,178 seaweeds. These figures are for 1892, but since that time many new species have been described, so that we may estimate that nearly 200,000 species are now known to mankind. This is a sample of the many interesting features which this book has to offer.

THE STORY OF THE SUBMARINE. By Lieut.-Col. and Brevet-Col. Cyril Field, Royal Marine Light Infantry. Philadelphia: J. B. Lippincott Company. 8vo., 304 pp.

In this volume the author, who is known as a careful student of military history, has given an outline of the history of submarine warfare and navigation from the earliest ages to the present day. The absence of technicalities and diagrams is explained by the desire of the author to satisfy the curiosity of "the man in the street" and provide amusement for the casual reader. In this aim he has been successful. The work is clearly written, the illustrations are ample for the purpose, and, as a story, the work is possessed of a decidedly stirring interest. It is not often that an author can be his own artist, but in the present case the whole of the one hundred illustrations are from the brush and pen of

Col Field The work possesses the important quality of strict impartiality, and the degree of credit attaching to the several inventors who have assisted to bring the submarine to its present stage of perfection is assigned with excellent judgment

CANADIAN PATENT OFFICE PRACTICE Definitions for guidance in preparing and prosecuting applications and other proceedings relating to patents By W J Lynch Chief Clerk of the Canadian Patent Office Ottawa The Mortimer Press 1909 114 pp

Canada is every year becoming a very important country in which to protect inventions and the number of patent applications filed in the Canadian Patent Office is becoming so great that it is necessary for the authorities to make numerous rules on the many questions which are continually arising Mr Lynch who is the chief clerk in the Canadian Patent Office has in this book codified the Canadian Patent Act most of the sections being supplemented with paragraphs in which the practice of the Canadian Patent Office is fully explained There is no other recent book on Canadian patent practice to which a practising attorney may turn for reference and as this book not only contains the law as it has been built up from the many rulings of the Canadian Patent Office but as it also has been arranged in compact form there is little doubt that every attorney practising before the Canadian Patent Office will see the necessity of keeping one in his office for constant reference

MANORS OF VIRGINIA IN COLONIAL TIMES By Edith Tunis Sale With 67 Illustrations and 22 coats of arms Philadelphia and London J B Lippincott Company 8vo 310 pp Price $5

The stately colonial homes of Virginia which in individual cases have been the frequent subject of attention by the artist and descriptive writer are here treated collectively in a volume of undisputed charm and historical value Twenty four of the most notable manors of Virginia have been selected and the choice has been made with a wise discrimination In a work of this character there are certain famous manor houses which must inevitably become the subject of more extended notice and while the description of each colonial home is ample particular attention has been given to such noble residences as Shirley Westover Brandon Monticello the noble pile of Berry Hill and Estouteville Accompanying each chapter is an illustration generally a front view of the mansion and a reproduction of the coat of arms of the family Other illustrations show the principal interior views and particular interest attaches to the excellent reproduction of portraits painted by the early masters of the famous owners of these famous homes The text is principally concerned with the history of the various families and the personality and fortune of their principal representatives although in each case there is a brief description of the principal architectural features of the building This work which is handsomely printed on heavy deckle edge paper is a most valuable addition to the literature on this subject

PAINTS FOR STEEL STRUCTURES By Houston Lowe New York John Wiley & Son 1910 12mo, 115 pp Cloth $1

Some forty years ago the author of this book had his attention brought daily to the consideration of the manipulation of paint (its properties and the results of the various operations to which it was subjected) by the questions raised by painters engineers architects builders and constructors During all this time the author has continued his observations and tests on a scale which has increased in elaboration and with careful attention to every point needing consideration This little handbook was written by a paint maker and is the direct result of study recently given to the manufacture and proper tiss of structural steel and the use of paint in its preservation It is published in the hope that some of the mysteries heretofore associated with the paint business may be cleared up

RHODES'S DIRECTORY OF PASSENGER STEAMERS London Published for Thomas Rhodes & Co by George Phillips & Son Ltd 1909 16mo 249 pp Price $1

The present volume is based on a publication issued some twenty three years ago entitled Holidays Afloat and after undergoing various changes results in its final appearance in this present form In 1886 the public wanted descriptions of sea trips the taste for ocean travel then just growing and Holidays Afloat met this demand The great ocean steamship companies were not slow to perceive that it would be to their interest to publish a series of booklets of a similar nature and accordingly publications of the kind were put in circulation It is not easy to sell people anything which they can get for nothing so that to meet the new conditions the scope of Holidays Afloat was extended and to the descriptions of sea trips added particulars were of sailing and fares on all the principal lines forming a sort of Bradshaw of the Ocean and also a directory of the passenger steamers mentioned in the book and the publication was renamed Rhodes's Steamship Guide But again the demon of generosity appeared on the scene and a large tourist company issued a monthly sailing list which provided more information than could possibly be obtained in an annual, therefore the scope of the book was again changed into a Directory of Passenger Steamers, giving information which would be prized in all parts of the world. The book contains a list of fleets of the principal lines of the world, then follows a directory of passenger steamers giving most valuable information relative to the builders, full dimensions, and something as to speed, accommodations, etc A new edition is in preparation which will be reviewed on publication.

THE NAVIGATOR OR MARINERS' GUIDE. A Handy Reference Work for the Use of Navigators, Yachtsmen and Students of Navigation By Capt. R. M Pugsley Jersey City New Jersey Paint Works, 1905 8vo., 202 pp.

Some idea of the importance of this book may be gained from the fact that 30,000 copies have been issued, and the second edition has been revised and added to with valuable matter not generally found in a work of this kind, and which does not exist in a manner conveniently accessible to those for whom this volume is intended, and in so doing the requirements of the practical experienced navigator and the yachtsman and student have been considered with equal care, at the same time preserving the general arrangement of the original work. Only such matter has been introduced as is known to be of real value to those interested in nautical subjects. It is filled with information which is of the greatest possible value to any ship master or officer It is well illustrated and the tables are excellent

SICILY, THE GARDEN OF THE MEDITERRANEAN By Will S Monroe Boston L. C Page & Company, 1909 12mo., 403 pp Price, $3

The present volume is the result of a tour through Sicily during the past winter and a rather extended study of the history and literature of the island The aim of the author has been to interest the general reader of travel and description and to inform prospective tourists of the Garden of the Mediterranean and to refresh the memories of those who may have already made the tour With these three classes of readers in mind, it has been necessary to cover quite a wide range of subjects of more or less popular interest The author has placed special emphasis on the distinctly human side of the subject, and while not neglecting the geography of the island and its diverse physical features, it has been, after all, the Sicilians themselves—their manners, customs, habits and institutions—that have received the lion's share of the book The illustrations are excellent and are well reproduced The paper is tinted in cream which is very pleasing to the eye This book should command a considerable sale

DER MENSCH DER VORZEIT Erster Teil Der Mensch in der Tertiärzeit und im Diluvium Von Wilhelm Bölsche Stuttgart Kosmos, Gesellschaft der Naturfreunde

In this book Mr Bolsche has presented a simply worded and therefore popular account of prehistoric man. The usual speculations on the mind of primitive man open the book whereupon the author passes to important discoveries and deductions to be drawn there from.

In the answer to Query 12,165, by an inadvertence we divided the ohms by the volts to obtain the current, instead of dividing the volts by the ohms. Of course everyone would see immediately that this was a slip and not an error of ignorance We thank our friends for their close watch of our Notes and Queries

A NOVEL AMERICAN MONOPLANE.

(Continued from page 140)

culated through the bearings and the crankshaft by a gear-driven pump A narrow Livingston radiator is mounted in front of the motor, a short distance back of the center of the plane Two torpedo-shaped gasoline tanks connect the two sets of front and rear uprights at the center of the machine

The single surface of this monoplane consists of seven sections—a central one and three on each side Both the spars forming the front edge and the rear spar, 10 inches in advance of the rear edge, are divided on each side of the center section into three 5-foot lengths. These spars are jointed together by sheet steel sockets and are securely held in position by cables, forming a double king truss and passing over the king posts located at the junctions of the sections. The cables are attached to drill rod hooks, which are quickly adjusted Bicycle spoke nipples and eyes are made use of for tightening these cables. Heavy ribs extend from front to rear at the joints of the various sections. These ribs are trussed by an inverted rib and drill rod ties. The single surface, which is formed of Baldwin's vulcanized Japanese silk-proof material, and which is colored black according to the fancy of Mr. Pfitzner, is laced on in sections and is held to the ribs by feather bone and tacks. A section 30 inches long is left out at each end of the plane. This section is to be occupied by the sliding wing tip These wing tips or equalizers, which are 30 inches wide by 5 feet deep, have the same curvature as the main surface, and are each formed of three ribs connecting a front and rear edge, which slide in a suitable track made of steel tube rails extending the whole length of the outer section of each wing, i. e., 5 feet, and allowing the sliding tip a 30-inch travel. In their neutral position these wing tips extend 15 inches beyond the end of the wing proper When one is slid out the full distance (30 inches) beyond the end of the wing, the other is drawn in beneath the end of the opposite wing. These tips are connected by a long cable, which passes over pulleys and is wound around the control wheel, so that when the wheel is turned to the right the left wing tip is fully extended, and *vice versa*. As the area of each wing tip is 12½ square feet, when one is fully extended and the other withdrawn, there is a difference in lift at the end of the wings of about 50 pounds at 40 miles an hour, at which speed the machine lifts about 4 pounds to the square foot.

The horizontal rudder in front and the tail at the rear are mounted on two trussed rods extending about 14 feet in front of and 10 feet behind the main plane The horizontal rudder consists of a main beam about a third of the way from the front to the rear edge, upon which the ribs are mounted These ribs are connected together by a light front edge of wood and at the rear by a wire cable The rudder is balanced At its right end is a double vertical lever, which is connected by wires to a similar lever on the transverse shaft at the base of the control column The latter lever can be seen in the three-quarter front view of the machine A forward and backward movement of the control wheel depresses or raises the horizontal rudder The vertical rudder is connected to the control wheel in such a way that when the wheel is rotated about its vertical axis the rudder is set to turn the monoplane The motion is the same as that used in steering a bicycle The vertical shaft of the control wheel is mounted in a 4-inch bearing in the supporting bracket, the transverse steering lever being just below this bearing Cables connect the ends of this lever to a similar one on the vertical rudder In order that the length of these cables may remain the same during the fore-and-aft movement of the control wheel, the bracket at the base of the control column is arched so that the ends of the steering lever just mentioned are in the center line of motion The cable that operates the wing tips, and which is wound around the circumference of the steering wheel in a groove, is led by means of pulleys through the hollow shaft of the control column It leaves the pulleys in the center line of motion, so that its tension is in no way affected by the other movements of the control wheel. The throttle lever for the carburetor is placed on the side of the control column; a cable passes through this hollow shaft and over pulleys to the carburetor A switch button for short-circuiting the magneto is also mounted on one of the spokes of the control wheel. This whole controlling mechanism is extremely simple and doubtless will be widely used in the future, as we understand it is the inventor's intention to give it to the public and not to patent it.

All the woodwork used in the construction of this monoplane is of spruce. The spars and struts are solid and have their front and rear edges tapered, while the ribs are laminated With the exception of the motor, radiator, and steel cables, the whole machine is finished black and

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending February 1, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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makes a very striking appearance Mr Pfitzner has already made a number of short flights in which he was able to get off the snow-covered ground within a distance of about 100 feet The machine is very speedy and so far has shown excellent stability On one occasion it whirled completely around when the vertical rudder was turned too sharply and yet in doing this it kept a level keel and was not damaged The running gear has been broken and will have to be made somewhat stronger, but otherwise the machine has shown itself to be very strongly and well constructed The novel slid ing wing tips used on this machine are quite different from the system of warping the planes used by the Wright brothers, and from the first trial flights at least they appear to be fairly effective Not until more extended flights have been made however can their true value be determined

SMOKELESS POWDER

(Continued from page 151)

dry in some ways—the cotton being digested in centrifugal wringers of a sort akin to those in which clothes are washed The atmosphere is intensely acrid and the stranger coughs in the biting air, to which the throats of the operatives seem to be indifferent When the cotton has soaked sufficiently, it shows signs of heating by emitting a dense brownish smoke It is then tumbled into vats of running water, and there 'drowned' before being wrung out in another mechanical wringer The cotton, before innocent has become an explosive In fact, in guncotton or pyro-cellulose Its subsequent stability and value as a propellant now depend upon the thoroughness with which all traces of the transforming acid are extracted from the "pyro, as it is commonly called

To this end, the "pyro" is next put into open tubs loaded upon a flat car, and carried to steaming tanks where for two days it is boiled and boiled to extract the major part of the clinging acid We know we are dealing now with an explosive by the sharp reports that come from under the car wheels as they pass anon over small bits of nitrated cotton Next the stewed cotton is taken to the pulping house, where it is pulped and poached like the materials used in paper making The water is changed often, and after twenty or thirty hours working, the "pyro is quite freed of the last trace of acid These various operations do not undo the nitrating The chemical metamorphosis accomplished in the cotton by the acid is permanent, and the boiling and washings serve only to remove spent and unabsorbed acid The slimy pulp is now put through a "wet machine" coming from the rollers in flakes containing about 40 per cent of moisture Thence it goes to the dehydrating house, where all but a small percentage of the moisture is extracted by successive applications of pressure and, finally, by the use of alcohol which drives the dampness before it leaving just enough of the spirits behind to form the needful solvent when ether is added The ether is poured in and the stuff is ground and mixed in a mechanical kneader After half an hour's working the material resembles damp cracker crumbs Chemically the pyro is now solvent and has undergone another change, requiring only the proper amount of pressure to produce homogeneity The "colloid" for such it is is then pressed into cakes weighing fifty pounds, which suggest soft rubber and are dully resonant The stuff is no longer white but looks like syrupy maple sugar The amber-colored cakes are then subjected to a heavy pressure and the plastic stuff forced through steel collanders whence it issues in cords like solid macaroni Again, for the sake of more perfect union these cords are pressed into a single compact cake, and then the plastic mass is

(Continued on page 152)

Cigar bunches from molds machine for removing O Tyberg 947,869 947 870 947 871
Clamp W L Glidden 947 811
Clevises, pin locking means for G F Mills 948,277
Clutch H W Butler 947 002
Coal preparatory to coking treating and handling W J Patterson 948 074
Cock plug H J Richard 948 075
Cock regulating, W N Best 948,030
Coin controlled lock Farnsworth & Reed 948 212
Coin freed lock for caretakers J K pal 948,205
Computing machine A Z Sea 948 077
Concrete tank silo cistern and the like molding machine H G Meats 947 027
Condenser C B Letsche 947 847
Conveyer J Ashford 948 080
Cooker steam H A Stoddard 948 140
Cooking device with heat regulator gas H Junkers 947 914
Copper and copper nickel ores treatment of pyritic J L Carrick 947 789
Corn husker J A Stam 948 207
Cover Hook and box F A Riley 947 840
Cultivator J Upshaw 948 202
Cultivator H S Warner 948 030
Cultivator bar attachment for Horn A Smith 947 910
Cupboard and table closet combined J J Armstrong 947 965
Curtain fixture A Tyler 948 001
Curtain fixture rotary H Ruthardt 947 853
Curtain edge support F H Hampton 947 907
Cycle belt tightener motor G H Meier 948 181
Cycle motor L D Robinson 948 250
Decorated fabric J A Grueldt 947 814
Dish washing machine I L Franken 948 046
Display apparatus T Lennox 947 828
Display rack, J A Bogar 948 203
Dividing circles or arcs of circles device for A D Ide 948 172
Door catch W O Taubert 947 885
Door closer W F McKibbe 948 282
Door check E Dumont 947 865
Door hanger J Olson 947 930
Draft appliance for fireplaces S A D Dean 948 007
Draft equalizer Elliott & Schlachter 947 801 947 804
Drum muffler snare M Waechtler 948 106
Dust separator C C Wickwire 948 062
Dye red basic W Konig 947 918
Dye red to violet wool M Weller 947 876
Egg beater C W Fisher 948 214
Egg tray D D Granger 947 813
Electric circuits apparatus for alternating the polarity of current in G Habeck 947 781
Electric furnace J H Reid 947 849
Electric fusible cut-out F Schattner 948,208
Electric light fixture W A Hutton 948 095
Electrical time limit switch P K Stern 947 981
Electrically wound mechanisms contact device for B F Kessler 947 831
Electromagnetic waves with sound regulated frequencies system for the transmission of W H Bathrick 948,156
Electroplating apparatus W H King 948 056
Electrothermostat regulator H Gernsback 948 275
Elevator L Kantor 948,170
Embalming apparatus W H McCourtie 948,115
Engine See Internal combustion engine
Eraser blackboard H W Mitchell 948,184
Excavating machine G Holmes 948 051
Exhaust pipe J Player 948 020
Fastener O Jones 947 820
Fastener C J Lubeck 948 071
Feed pan poultry G F Lewis 948 014
Feeder stock D T McKinnie 948 016
Fence making machine J A Beck 947 848
Fence post L A Nelson 947 920
Fertilizer and producing same, L R Coates 947 706
Fertilizers producing L R Coates 947 706 947,708
Filter C Sellenscheidt 947 856
Filter press B Berkovits 947,883
Filtering apparatus N Marie 948 180
Fireproof arch E J Fitzpatrick 948 215
Fireproof shutter mechanism F McManus 948 239
Fishing reel J H Neuteboner 948 028
Floor grinder and polisher Jacobs & Lindroth 948 174
Flue cleaner C W Hadlock 947 905
Fluids process and apparatus for the interconversion of kinetic and potential energy in S Z de Ferranti 948,213
Flying machine, airship and the like V Wisniewski 948,121
Foldable table and attachment therefor, H F Thomas 948 191
Folding machine J Tomlinson 948 117
Food boiler and steamer I Wiegand 948 108
Force feed lubricator E Tilston 948 102
Forging machine G Berglund 947 960
Frame See Umbrella frame
Funnel F G Gollenberg 947 917
Furnace door operating device, O M Gossett 947 903
Furnace fire door G H Gregory 948 218
Furnace for melting metals and for like purposes J C Barker 948 126
Furnaces gas burning attachment for J F Coyle 948 173
Furnaces means for controlling draft air to boiler L Duffner 947 804
Fusing process S Meissner 947 835
Gage W Jorgensen 948 141
Galosh gum boot and other rubber foot wear D & F W Smith 947 860
Game apparatus, O C Miller 948 183
Game apparatus C F Doerr 948 200
Garment nether G Durkheim 947 801
Gas cleaning apparatus J Morgan 948 082
Gas generator, acetylene Dec & Fischer 948 080
Gas producer J Reuleaux 948 210
Gases utilizing nitrous K Birkeland 948 158
Gasoline feed A W Hofacker 948 270
Gate J L Landis 948 220
Glove cleaning machine kid H F Marshall 947 924
Gloves and the like, fastener for J H Fisher 947 808
Go-cart folding F & F F Timmerhoff 947 808
Gold apparatus for recovering fine J H Alling 947 958
Gold recovering fine J H Alling 947 957
Golf club, W D Kilgour 947 822
Golf links cup or hole rim for H Hinckley 947 819
Grease cup filling device Foessler & Smith 947 807
Grinder sand, G R Hills 948 139
Gyratory machine J Fraser 948 047
Hand bag J Kretling 948 165
Hand clamp or vise F H Kelley 947 915
Harrow A M Hauck 948 276
Hay or manure loading machine H G & W J Collins 947 994
Hay press G W Wilson 947 877
Hay rake J Dain 947 863
Hides and skins machine for treating D I Cummings 948 208
Hinge Olson & Lersson 948 079
Hinge O R Milke 948,112
Hobby horse A F Smith 948 257
Hoisting and conveying apparatus, semi portable, A Lambert 948 281
Horseshoe J G Owens 948 244
Hunting knife C Romano 947 986
Husking roll teeth T I Brumback 947 787
Ice apparatus for making artificial W H Bull 948 131
Identifying device G W Lott 948 090
Index cabinet card B Ohnstead 947 842
Indicating mechanism D E Berafford 947 948
Indigo and making it halogenated P R Oberreit et al 948,141
Insulator W S Cone 947 985
Insulator electric light pull T M Harrigan 948,109
Internal combustion engine F C Bennett 948 105
Internal combustion engine F Renagh 948 248
Jewel bar H W Fishel 947 997
Jewelry H W Fishel 948,044
Joint See Ball joint
Journal box for mining cars W H Bines 948 003
Key and lock C F Jenkins 947 915
Knitting machines, splicing feed device for G S Marville 947 985
Labeling packets, tins or the like machine for E C Lovell 948 061
Lace clamp shoe J C & A M Foster 947 809
Lamp ball clutch for arc J T Beechlyn 948,286
Last K O Kreutler 947,973
Last S T Hennessey 948,086
Lasts, jig for boring jack holes in, W H. Bayward 948,284
Lasting machines, holddown attachment for, E F Mulleran 947,838
Latch, door, G. Wettig 948,119

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placed within the cylinder of the powder press.

Under an impulse of from 4,000 to 6,000 pounds pressure to the square inch, varying with the size of grain, the powder issues through dies in the form of an endless snake of pale yellow, perforated from end to end with a concentric group of circular passages. As the cord comes from the press it is cut into grains of uniform length; the size of these units and the number of perforations depending upon the caliber of the gun. The purpose of the small lengthwise passages is to insure a compensating burning surface, which increases directly as the external grain surface diminishes under the attack of the flame. This gives the powder its *progressive* burning quality, so needful in securing the desired ballistic results without undue stress upon the weapon.

The actual fashioning of the powder is now complete; but there are still things to be done before it is fit for issue to the service. As it was with the nitric acid, so too is it with the ether-alcohol solvent, the stability of the powder depending upon the degree to which this volatile is extracted. Some of this solvent is removed by distillation, and thousands of dollars worth of it are recovered annually and used again. The final stage of dryness is reached by storage in drying houses, the period varying from six weeks to six months according to the size of the grain. Then, after being tested by actual firing, and mixed with grains of other groups to secure a desired average, the powder is put up in air-tight tanks ready for issue. The object of careful sealing is to arrest the escape of the remaining solvent, which acts as a deterrent and prevents the explosive from becoming too quick in its burning, thus serving to check the development of sudden and dangerously high pressures in the gun.

Smokeless powder can be dampened, and, provided it does not mildew, is as good as ever if properly dried again. After eight or ten years the powder becomes unstable and even crumbles, but it can be sent back to the factory, be reworked, and turned out once more a good explosive at an outlay of only one-fourth of its original cost. This is proof of the indestructible nature of its base—pure cellulose—which however defies the cunning of the chemist and holds secret the ways in which sunshine, oil, and atmosphere work mysterious differences in the minute cells of each delicate filament. The cotton from Georgia does not make the same powder as that from Alabama, and the blooms of Tennessee give us the best propellant. The problem for the manufacturer is to combine these various growths, so that he can make the nearest approach to a perfect and uniform powder. Each lot of powder has its own characteristics within limits, and a sample of each lot is kept under continual scrutiny in a surveillance magazine so long as any of these lots are in service. Daily, these telltale samples are examined. If changes of a vital nature are detected, information is at once dispatched to every ship upon which the affected powder is carried.

Though smokeless powder has proved a boon, still it has one serious fault which has not been effectually overcome; its explosive temperature is quite 4,500 deg. F., and this is nearly twice the melting point of steel—the material from which we make our guns. The development of this intense heat is merely momentary, yet it damages seriously the bore of the gun if the hot gases escape past and ahead of the moving shell, because they act like the flames of a powerful blowpipe and sear away the rifling surfaces of the weapon. Here is a problem for the chemist. Smokeless powder is not as easily ignited as ordinary gunpowder, neither can it be detonated by a blow, and a small quantity of the old black propellant is added to each charge to facilitate

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Level attachment for straight edges, O. H Loeb 948,232
Light-sensitive layer carriers and film structure therefor, device for exposing, J Schmeck 947,946
Lime and gas, manufacture of, G G. Floyd 948,045
Line casting machine, R. F Mercer 948,182
Line supporter, H. W Wells 948,002
Linoleum, manufacture of, W D. & D L. Snow 948 189
Liquid cooler, R. Russell 948,202
Liquid fuel burner, F C. Richardson 947,943
Liquid treating apparatus, K W Bartlett 947 783
Loading apparatus, R. C. Gilne 947 902
Lock, J. W. H. Taylor 947 866
Lock, A. Tebikka 947,941
Lock, J. Junkune 948,280
Locks, stop-work mechanism for, C A Berry 948,201
Locomotive, electric, W B. Woodard 948,164
Locomotive engine, H. D. Taylor 948,008
Locomotive exhaust pipe, J Player 948 021
Loom shuttle, cotton, V Leveque 947 830
Loom take-up mechanism, A B. Rhoades 948,024
Lubricating axle boxes and the like, means for, A. J Smith 948,283
Lubricating device, B. Hutton 948,224
Lubricator. See Force feed lubricator
Lumber, siding, G. V Conger 948,160
Mail bag deliverer, M N George 948,217
Mail bags and similar articles, closure for, A. Hormel 948,052
Mail delivery chute J & H. Page 947 848
Mail handling device, J H. Buchanan 948,087
Mailing receptacles, card attachment for A. E. Bingham 946,202
Manifolding devices, carbon holder for, M. B. Everall 948,211
Massager, A. B. Campbell 948,005
Match machine, Tatum & Parker 948,027
Match safe, J S. A Nicholson 948,017
Measuring and weighing machine, grain C D. Crowley 948,289
Measuring machine, grain, C D. Crowley 948,290
Merry-go-round, J S. Tuttle 947,954
Metal frame screen, S. W McGrath 947 838
Metal manufacture, expanded, N E. Clark 947,794
Metallic silicids, manufacture of, O Strauss 948,190
Metering panel board, J J Agutter 947 906
Milk can, L. B. Steel 947 863
Milk can, glass lined L. B. Steel 947 864
Mill spindle grinding, A M Tully 947 953
Mirrors, pictures, or other small objects, means for supporting C B Moore 948 113
Miter box, W Potter 948,022
Moistening device, P H Lombard 948,110
Molding box, A Behrns 948,253
Molding flask drag W Fawcett 948,107
Mop and hardwood floor device combination R. T Baskin 947,959
Motive power producing machinery, G. Teller 947 807
Motors, speed multiplying mechanism for A L. Hegiar 947,908
Musical instrument, mechanical, H Frommdorf 947 899
Mutoscope, A S. Ferguson 948 272
Needle case, J S. Gardner 947 967
Nickel and copper from ores and mattes, recovering A Chalas 947 791
Nozzle exhaust, J Player 948,019
Nozzle for steam boilers, W Horsley 948 053
Nut cracker, S. C Peckham 947 932
Nut lock A A Brown 948,089
Nut tapping machine, J Bosma 947 961
Oil burning system, H Duke 947 800
Oil switch, H. L. Smith 947 860
Organs, electric coupler action for, J O Funkhouser 948,010
Packing, rod, P Dorsey 947 869
Padlock, combination, L. L. Kellogg 947 994
Padlock, combination, L. Rosen 948 251
Paper and other substances, decorative treatment of, H O Mitchell 947,073
Pencil holder J G Watanabe 948 118
Pencil, mechanical, G Arnuds 948 124
Pencil protector and sharpener combination T Goodair 947,812
Percolator, coffee, P Edthauer 948 108
Photographer's chair, C E Herman 947 000
Photographic tray W G Rice 947 942
Photography, color, F L. Dyer 947 965
Piano shield, M J Bean 947 784
Pipe joint packing machine, O E. Miller 947 837
Pipe machine O R Burlingame 948,104
Pipe threading machine, Walter & Troup 948 102
Planter, corn, J C. Coleman 947,790, 947 800
Planter, corn J N Stout 948 280
Planter cotton J Clark 947 884
Plow attachment, S R. Evans 948,210
Plow, wheeled W L. Paul 948,247
Plow attaching J C Dallam 947 887
Plug socket and switch, combined electric connecting W W Buckton 948 041
Pocket knife, L Kinney 947 825
Post hole digger E Sutherland 947,952
Pot handle pivotal P Rotondo 948 187
Powder box W H Perkins 947 984
Powder ejector, Kline & Long 948 057
Presser foot C A Potter 948,100
Printing machine, ticket Stenhouse & Eastham 948 070
Printing press, web, F M Turck 948,261
Projectile, aerial R Lehmann 948,177
Pruning implement, C I Libby 948 231
Pulley split, W H Stockham 948,090
Pump J B. Garber 948 168
Pump, W H Heard 948 302
Pump, centrifugal F W Krogh 948 228
Pump coupling B. F Mohr 948 072
Pump, multistage centrifugal A Giesler 948 292
Pump, rotary mercury vacuum H A Fleuss 947 088
Pump, G Clark 948 132
Pumps, counterbalance for water W Koethe 948,227
Pumps, valve cage and valve for, J R. Garber 948,169
Pumping apparatus F S. Hebden 948 278
Pyrotechnical button A. Jedel 948 225
Quoin, J W. Talbot 948 000
Rack See Display rack
Radiator, W Wilkinson 948 083
Rail joint, F W Krueger 947,835
Rail joint A. A Lind 948,015
Rail joint, J K & B. W D Gorrell 948 089
Rail joint A C Jenrich 948,097
Rail laying apparatus, J Heinehr 948 068
Railway spike, J Deliwo 947 887
Railway switches, combined signal and lock for T B. Ashford 948,300
Railway switches, trap doors, etc, trip device for operating F M. Evans 947,896
Railway tie, J R. Miller 948,236
Railway tie and rail fastening means J J O'Donnell 948,243
Rake. See Hay rake
Razor and stropper combined F H Arnold 948 034
Reamer C J Crowley 948 209
Reamer expansion, W C Meyer 947 929
Reclining chair J E. Trimble 948 030
Reflector O M Fluke 948 216
Refrigerating apparatus, H G Scherer 948,101
Registers border for side wall, J Flood 947 910
Rein button, E. G Jegge 947 992
Rein holder, A Oresmen 948 166
Rendering tank and press, steam, C H Sindler 948 258
Ring gage G O Worstall 947,879
Riveting tool, J C. Woherman 948 246
Rocket, floating and luminous line carrying, H E. A. Garrard 947 904
Roofing, ready made, W H Pendery 948,116
Rosette, fuseless, H C. Wirt 947 878
Rotary engine, W G Sheppard 948,256
Rudder for controlling the various movements of screw-propelled vessels and means for operating same, J P H Lund 947 898
Saddle harness, W. G. Trask 948,051
Sagger, W W Babington 947 880
Sand blast machine, C. A. Dreisbach 948,270
Sash lock, window, T C. Staley 947 960
Sash weight, O. A Horner 948,171
Saw and handle for the same, J Ullrich 948,181
Saw, level, and square, combined, Larned & Hessel 948,098
Saw machine, drag, E J. McGhee 947,989
Saw swage, A E. White 948,297
Scraper, wheeled, J. P Robbins 947,944
Screw threads upon screws, machine for cutting, W Avery 948,300
Sealing and stamping envelope, machine for F. G. Madsen 948,179

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inflammation This explains the thin veil of smoke now seen when our guns are fired.

MORNING AND EVENING STARS FOR 1910.

(Continued from page 146)

ity in its orbit is 6 miles a second, and the period is 29 46 years Saturn's position is indicated at intervals of sixty days.

The plane of the orbit of Uranus is inclined at an angle of 0 77 deg to the ecliptic, which is less than that of any of the other planets The mean velocity is 4 2 miles per second at a mean distance of 1,781 9 million miles The center of the orbit is 82 6 million miles from the sun The planet completes its revolution in 84 02 years, and its position is shown at intervals of 120 days Neptune's orbit is inclined at an angle of 1 8 deg Notwithstanding the planet's great distance the linear eccentricity is only twenty five million miles The orbit velocity is 3 4 miles per second, and the mean distance is 2,791 6 million miles The revolution is accomplished in 164 78 years, and the planet's position is shown at intervals of 180 days

Neptune's distance from the sun is a very little over thirty times that of the earth $\left(\frac{2791\ 6}{92\ 9} = 30\ 055\right)$ The square root of the cube of this number gives the period, which is 164 78 years This illustrates Kepler's third law, viz The squares of the periods of the planets are proportional to the cubes of their mean distances from the sun By similar computations the relations between the periods and mean distances of all the planets may be shown to be those which are here given

HOW TO DETERMINE THE MORNING AND EVENING STARS

A planet whose orbit is within the earth's orbit is morning star between inferior and superior conjunctions and evening star between superior and inferior conjunctions Prior to conjunction a planet outside the earth's orbit is evening star, after conjunction it is morning star It should be noted however that when a planet is near conjunction, it is not far enough away from the sun for observation The longest arrows indicate the directions in which the major planets are seen at opposition, the shortest arrows the directions in which they would be seen at conjunction if the sun were out of the way At the date of opposition a planet is visible before and after midnight, and is therefore both morning and evening star

If the page be turned about one-quarter of the way around so that the earth in Plot I on January 8th (the date of the opposition of Neptune) is between the reader and the sun the positions of all the terrestrial planets on this day may be seen without turning the head The earth rotates in the direction of the arrow At sunrise an observer emerges from the shadow area at sunset he enters it All planets which in the plot are on the right rise before the sun and are morning stars, those on the left set after the sun, and are evening stars On January 8th Neptune is above the horizon before and after midnight, and is both morning and evening star Conjunction of Uranus with the sun occurs on the 11th Previous to this date Uranus is evening star, and subsequently morning star On January 7th Saturn is at quadrature, and is evening star On January 4th Jupiter is at quadrature, and is morning star On January 17th Mars is at quadrature, and is evening star On January 25th Mercury reaches inferior conjunction Before conjunction the planet is evening star and after conjunction it is morning star During the month of January Venus is evening star The planet is at inferior conjunction on February 12th, and after this date is morning star

The table gives the dates of conjunc-

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Seed linter and condenser, cotton F C Gammons	948 274
Sewer cleaning device M Harbeck	947 990
Shafts for vehicles, shifting W A Kitchen	947 824
Shaking screen O W Honsbach	948 232
Sharpener for scraper blades J F Weber	947 875
Sharpener knife and scissors M R Ingram	948 178
Sharpening device Engelbard & Reinig	948 134
Sheaf carrier attachment C M Hanna	948 013
Sheet metal box, Wootten & Richardson	948 122
Shield J A D'Andelet	948 107
Shipping case or box T T Copeland	947 993
Shirt combined athletic W T Anderson	948 199
Shock and hay loader J Corking	948 000
Shoe tree external H Stone	947 951
Shoes sandals, and the like making A B Eastwood	948,300
Sight feed lubricator down drop F W Edwards	948,301
Skiving machine F I Alley	948 032
Skiving machine, pressure roll for F I. Alley	948 031
Sled and propelling apparatus A J Offord	948 018
Sleeve for garments R Karp	948 142
Smelting furnace J R Lader	948 098
Snap switch H P Ball	947 881
Socketed members, securing means for A W Cochran	948 294
Soil antitoxin making L R Coates	947 797
Soldering the end seams of cans means for W J Phelps	947 985
Sound reproducing machine record D H Haywood	948 197
Spectacle cases, etc safety clamp for J W Trubove	948 287
Speed mechanism variable H W Schulz	948 025
Speed transmission mechanism, variable H R Geer	948,091
Speedometer J H Bullard	947 798
Spindle See Mill spindle	
Spool or reel for tape or the like R J Riley	947 897
Springless lock P J O'Brien	947 908
Steam and vacuum trap C D Tilliston	948 028
Steam trap L M Cooper	947 801
Steel J W Evans	948 106
Stoker locomotive automatic S D Griffin	948 220
Stone saw F I Hanson 947 969	947 969
Stove F F Lesley	947 829
Stove charcoal A W Stickle	948,259
Stove or cabinet cooking C H Adams	947 770
Stovepipe ventilator L F Hall	947 816
Strainer J M Mulhair	948 183
Street cleaning machine J W Dougherty	948 104
Strength testing machine W H Johnson	948 140
Surfacing roll, A Bevan	948 157
Sweeping machine J Cable	947 951
Switch throw H M Cheek	948,206
Table J Wallin	947 962
Talking machine, J R Browning	948,040
Tank attachment storage and refrigerating W Griesser	948,219
Tantalum purifying E Weintraub	947 983
Telegraph trolley and like pole, metal J F Craven	948 088
Telegraphy directed wireless Bellini & Tosi	948 086
Telegraphy wireless, R A Fessenden	948 068
Telephone transmitter R T Evans	947 066
Telescope binocular A Konig	947 971
Thresher pea R O Blackwell	948 180
Threshing machine concave W I Hay	948 277
Tie See Railway tie	
Tie plate, R H Bell	948 127
Tile coating machine F B Goldsmith 948 011	948 012
Tire armor C H Maddox	947 834
Tire for vehicles pneumatic C E Titus	948 108
Tire shoes making Seiberling & State	948 004
Tire spring, R J Lackner	947 820
Tobacco stripping machine C F Hall	948 170
Tool compound J H Nantz	948 240
Tool pneumatic W H Seley	947 861
Toy A I Doerr	948 163
Toy bank J F Schmaufer	947 909
Toy vehicle J W Arney	947 790
Train order catcher L C Schweppe	947 009
Train service coupling I D Turner	948 150
Traveler holdown device for loading Cobb & Fleming	948 101
Traveling case and bag S Grossman	948 170
Trellis metallic J F Jaquet	947 912
Truck and stand combined jack H N Day	948 259
Truck dumping or unpacking W A Ellis	948 011
Truck locomotive H D Taylor	948 007
Trucks, swivel plate for motor A Christianson	947 702
Trunk hat O Rangnow	947 938
Trunk wardrobe, O Rangnow	947 040
Tumbling device B F Sawyer	947 865
Turbine steam W Kilmer	948 178
Type setting and casting machine H Degener	948 291
Typewriter line lock mechanism M B Sargent	948 147
Typewriting machine H I Wagner	947 873
Typewriting machine A C F Kurowski	948 058
Typewriting machine A C Smith	948 065
Typewriting machine O A Martini	948 145
Typewriting machine, A Obernolte	948 146
Umbrella frame L H Carter	947 700
Valve automatic shut off M H Farley	948 135
Valve foul gas O F Grein	948 049
Valve gear engine G Horvath	948 223
Valve mechanism for water elevators, J I Latta	947 827
Valve rocker S A Palms	947 841
Vaporizer for medicines A C Whitehorne Cole	948 153
Vehicle wheel H E Cherry	948 042
Vehicle wheel O Schott	948 076
Vending machine A B Jones	948 228
Ventilator See Stovepipe ventilator	
Vessel capping machine J A Hicks	948 139
Vessel submarine S Lake	947 021
Vine Dix & Van Cleave	947 888
Vise, D Kovacs	947 919
Vote registering machine D L Newcomb	947 840
Voting machine D L Newcomb	947 839
Wagon bolster spring J I & A Hagel	947 815
Wagon brake I Dockins	948 090
Wagon brake C W Lage	948,246
Wagon, dumping, E E Gessman	948 092
Washboiler attachment W F Fessler	948 008
Washing machine W M Kincaid	947 916
Washing machine J Schwartz	948,255
Waste and overflow trap F W N Booney	947 796
Waste plug mechanism for lavatories and the like J Allingham	948 033
Watch holding case W E Porter 947 938	947 087
Water closet J A Barr	947 782
Water wheel submerged W B Campbell	948 105
Waves apparatus for utilizing the movement of the sea A Ravelli	947 846
Weed destroyer, P Hall	947 008
Weighing machine automatic A J Ball	947 [illegible]
Well boring apparatus, A A Steel	947 862
Wheel or roller F S, Morton	948,093
Wheel rim or felly for pneumatic or solid tires J R Bradshaw	948,267
Wheel rim, supplemental, J L Hecht	948,136
Wrench, I J Basken	948,035
Zinc manufacture of O. Loiseau	947,961

A printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863, will be furnished from this office for 10 cents provided the name and number of the patent desired and the date be given Address Munn & Co, Inc 361 Broadway, New York

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc, 361 Broadway, New York

(Concluded from page [illegible])

tions and oppositions. The relative positions of the earth, the planet, and the sun at conjunction or opposition may be tested by a straightedge; or the date of a conjunction or opposition may be ascertained by this means. It should be noted that these dates are usually somewhere between those which are given in the plot and between Greenwich noon of one day and the next.

TABLE.

Greenwich Time.

	Opposition		Conjunction	
Neptune	Jan	8.58	Jul.	11 79
Uranus	Jul.	16.17	Jan.	11 71
Saturn	Oct.	26.87	Apr	16.62
Jupiter	Mar	30 75	Oct.	18.71
Mars			Sept	27.21
Venus			Feb.	12.00 (inf.)
Venus			Nov	26 04 (sup.)
Mercury			Jan.	25.87 (inf.)
Mercury			May	25 21 (inf.)
Mercury			Sept.	25.83 (inf)
Mercury			Apr	5 46 (sup.)
Mercury			Jul	19 17 (sup.)
Mercury			Nov	12 08 (sup.)

THE DESIGN FOR THE NEW QUEBEC BRIDGE.

(Concluded from page 148)

low height of 290 feet necessarily increases the weight of a cantilever, and if used for the towers of a suspension bridge would result in a flat catenary, requiring unusually heavy and expensive cables and anchorages. The great height of the towers and trusses in the Forth Bridge has an important bearing upon its rigidity under fast trains

The effect of low height and narrow width in raising the weights is shown in the fact that the amount of steel to be put into the Quebec Bridge in a length of 2,800 feet is estimated at over 66,000 tons The total amount of steel in the Forth Bridge in a length of 5,300 feet is 53,000 tons In other words, the narrow Quebec structure would require the enormous average amount of 24 tons of steel (about half of which moreover is nickel steel) per lineal foot, whereas the wide and rigid Forth Bridge required an average of only 10 tons of carbon steel per lineal foot It is true that the train loads assumed for the Quebec Bridge are about three times as heavy, but it is well understood that the weight of steel in any bridge of great span does not increase in anything like the same proportion as the live load

NEW OVERHEAD ELECTRICAL CONSTRUCTION ON THE NEW HAVEN RAILROAD.

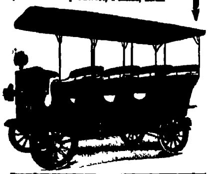
(Continued from page 140)

building, through the Westinghouse Company, an experimental freight locomotive, preparatory to operating its whole service, freight and passenger, from New York to New Haven, a distance of between seventy and eighty miles, entirely by electric power

At the time of its construction the present twenty three miles of electrified line between Woodlawn and Glendale, two miles beyond Stamford, was one of the most courageous and costly experimental works ever undertaken in the broad field of electricity The story of the unparalleled difficulties with which the company had to contend in developing the system to its present perfection, and at the same time keeping in operation one of the busiest four-track railroads in the world, has been told from time to time and in considerable detail in these columns. To-day this electric zone is running with the regularity of a watch, as may be judged from the fact that the delays through breakdown of the electrical locomotives are shown by the statistics of operation to be 100 per cent less than were the delays under operation by steam locomotives.

The experience gained during the past two or three years has revealed to the engineers some features in which the electric plant is capable of improvement. Particularly is this true of the overhead

(Concluded on page 155.)



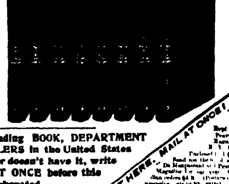
(Concluded from page 154)

work, which in the existing line is of a massive and decidedly costly type of construction In addition to its expensive nature, the present overhead line was found to have unnecessary rigidity, and it was decided that before extending the work to New Haven it would be wise to build a mile of experimental line, embodying the improvements suggested by past experience We present two photographs and a diagram which clearly illustrate the character of the new work In the old construction the line is carried upon massive steel bridges, spaced 300 feet apart, each bridge consisting of a pair of columns supporting a lattice truss which spans the four tracks Each trolley wire is hung from a pair of steel 'messenger' cables by means of a series of triangles, the messengers being hung in a true catenary and fastened to insulators attached to the top of the latticed trusses The trolley wire, which is maintained in a horizontal position passes below the supporting trusses The whole of this system—messenger cables, triangles, and trolley wires—is charged with current at the high potential of 11,000 volts

In the new system a successful attempt was made not only to lighten the construction, but also to provide one whose appearance would be lighter and more graceful Furthermore, the cables and wiring have been so arranged that the main carrying cables and the main pipe hangers are not charged, and the only live portion of the work is the catenary trolley, and contact wires

By reference to the engravings it will be seen that the place of the massive bridges is taken by a pair of relatively slender tapering, columns, which are curved inwardly until they terminate above the centers of the outside tracks To hold the columns in a vertical position and prevent their sagging under the load of the cables a length of steel pipe trussed with wire, is introduced between the opposite incurving ends of the columns The duty of carrying the wiring falls upon two 1¼ inch steel wire cables which are secured at the ends of the latticed columns, and extend continuously throughout the whole line Depending from these cables at intervals of 100 feet are a series of main pipe hangers each of which consists of a horizontal 3 inch pipe which is hung from the cables above by two pairs of supports formed of 1¼ inch pipe All of this construction thus far described, columns, main cables and main pipe hangers, is at all times dead none of the current being allowed at any time to pass through it—a feature of the greatest importance when it comes to the question of making quick repairs to the line, or of adjusting the set of the cables Attached below the transverse horizontal members of the pipe hanger are four porcelain insulators, which are adjusted so as to lie vertically above the four tracks, and this feature of adjustment is one of the great improvements of the new over the old line Upon the insulators are strung the four steel track messenger catenaries, below which, carried on short vertical pipe hangers of graduated lengths, is the copper trolley wire An inch or two below the trolley wire and supported therefrom by steel clips, is the steel contact wire, against the under side of which the collector shoes of the locomotives bear with an upward pressure of about 25 pounds The method of attaching the contact wire to the trolley wire at points intermediate with the points at which the trolley wire is itself suspended, provides a system of equalization which gives to the system an even flexibility throughout its whole length, and insures a continuous contact and a consequent freedom from sparking

The management of the electrical zone of the New Haven Railroad Company and its engineers are to be congratulated in having made such a marked improvement, both from the constructive and æsthetic standpoints, over the existing line between Stamford and New York



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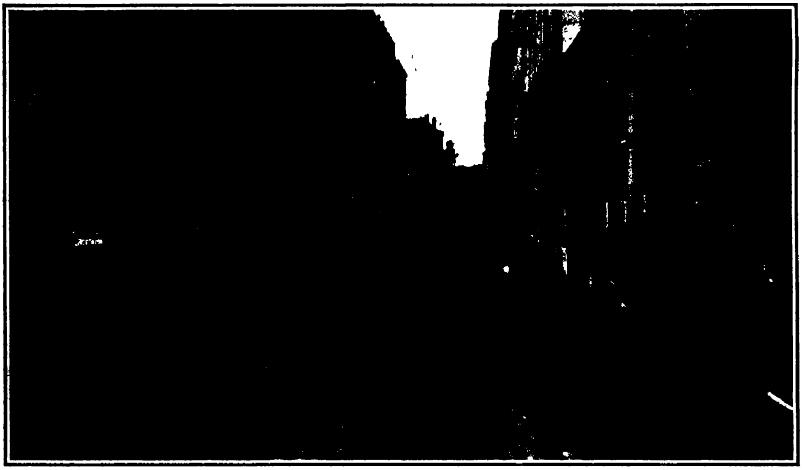
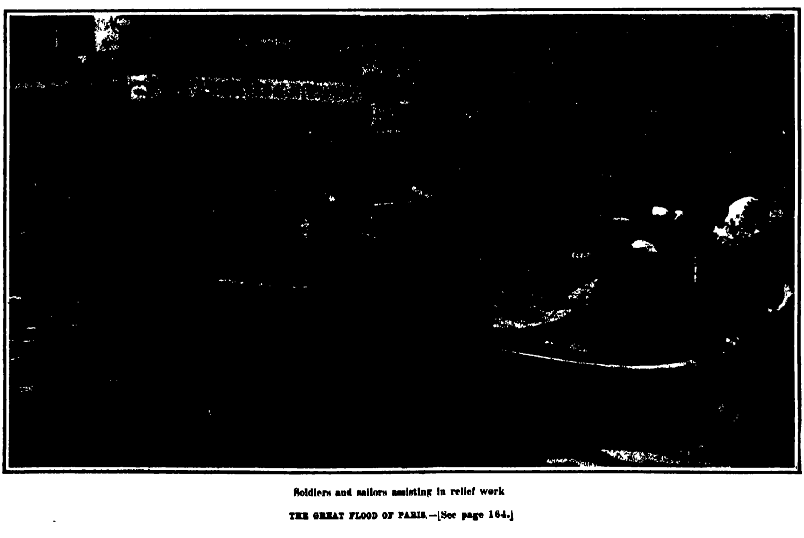


The Rue Surcouf was converted into a Venetian canal.



Soldiers and sailors assisting in relief work

THE GREAT FLOOD OF PARIS.—[See page 164.]

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NEW YORK, SATURDAY, FEBRUARY 19th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SECRETARY MEYER'S PLAN FOR THE REORGANIZATION OF THE NAVY

THAT one of the first acts of Mr. Meyer on assuming the extremely difficult and responsible position of Secretary of the Navy, would be to make a thorough investigation of conditions with a view to placing that very complicated department upon a more practicable working basis, was inevitable, as everyone must have foreseen who is familiar with the excellent work of reorganization which he achieved while holding the position of Postmaster-General.

The changes introduced by Mr. Meyer are necessarily *supplemental to the work of his predecessor* Mr. Newberry, who had formulated and put into effect a system of consolidation which, in the brief period of its operation, had shown excellent results. Mr. Meyer has assured us that the changes which he has instituted in the Newberry plan have been made not for the purpose of reversing but rather of amplifying the work of consolidation inaugurated by his predecessor. The essential changes involved in Mr. Meyer's plan are summarized under the following heads:

(1) The provision of four responsible advisers (of the Secretary) on subjects within the groups into which duties of the Department logically fall.

(2) The grouping of the Bureaus into two divisions of material and personnel according to the nature of their duties.

(3) The establishment of a Division of Operations of the Fleet.

(4) The establishment of a comprehensive inspection system of a permanent organization whose officers shall be periodically changed, who will come mainly from the active fleet and be conversant with the latest ships and the modern methods of drill and organization.

(5) The establishment of a modern and efficient cost-keeping system in the Navy Department and at navy yards.

(6) The separation of navy yard work into the two natural divisions of hull and machinery.

(7) He intends to require that commandants and captains of yards for navy yards shall be selected for their knowledge and experience and that their tenure of office shall be long enough to insure continuous administrative policy.

The SCIENTIFIC AMERICAN has before it the printed record of the hearing of the Secretary and various Bureau chiefs before the House Naval Committee appointed to consider the proposed reorganization, and, after giving the same a most careful reading, we have come to the conclusion that, with one very serious exception, the measures proposed by Secretary Meyer are well adapted to promote that consolidation which Mr. Newberry began and which the present Secretary is endeavoring to place upon a lasting workable basis. The appointment of four aides, independent of the Bureaus, whose duties will be to inform and advise the Secretary on matters coming under the four general heads, is an excellent arrangement, the need for which had been keenly felt by previous secretaries. The Aides for Operations of the Fleet, for Personnel and for Inspections are to be line officers. The question as to whether the Aide for Material should be chosen from the line or staff is left open. We are decidedly of the opinion that in seeking for advice on the question of material that is ships, engines, navy yards, etc., the Secretary should have as his aide the Chief or some high ranking Naval Constructor, who by training and experience is best qualified to advise upon these subjects. A proportion of three line officers to one staff officer among the aides would give a fair representation of both branches of the service, and would put the Secretary adequately in touch with the whole range of active work in his Department.

The feature of Secretary Meyer's plan which we consider to be open to very grave question is the proposal to separate the navy yard work into two divisions of hull and machinery, with a separate and independent manager for each, for the change involves the defeat of one important object of the Newberry plan as affecting the navy yards, namely, the securing of efficiency, and the avoidance of confusion and delay, by placing the whole of the work affecting the construction of the ship in charge of the officers of a single corps, with a member of that corps as general works manager of the yard. Mr. Meyer recognizes that a navy yard is a military establishment and must be under military government, but this condition was met under the Newberry plan by placing at the head of the yard a commandant who is always a line officer of high rank. Under him came the manager, a naval constructor, whose executive powers were recognized as covering not the military, but the industrial side of the work. In view of this distinction, we fail to see how the management of the yard as to its non-military and purely industrial features by a staff officer of the naval construction corps is, in any possible sense, a violation of that law of Congress, according to which a staff officer cannot exercise military command over any other than members of his own corps. Under the former or Newberry plan, line (sea-going) officers of the Engineering Corps, who were temporarily assigned to the steam engineering department at the navy yard, were subject to the naval constructor manager, purely in the industrial and not in the military sense.

If it is advisable for economy and efficiency and the consensus of evidence is overwhelming on this point, that the navy yards should be under a single industrial management and that this management should rest in the naval construction corps, and if under such an arrangement any legal question is involved as to the right of the constructor-manager to exercise non-military authority over engineer officers of the line who may be temporarily assigned to duty at the yard, then the sooner the law is modified the better for the interests of the navy, and of the American people as a whole.

If it be asked why both hull and machinery should be placed under the control of a single head, and that head the naval constructor, we reply that the hull and the machinery are merely subdivisions of one organic whole, and that the two are so greatly interdependent as to make it necessary that their design, construction and subsequent repair be under the management of a single corps, who are qualified for the work by training, knowledge and practical experience. Now, we venture the statement without any fear of successful contradiction, that the one body of men who combine the necessary knowledge of naval architecture and steam and electrical engineering to qualify them for the oversight of the construction and repair both of the hull and the machinery is the corps of naval constructors. Unfortunately, much of the evidence which has been given before the committee has been directed to proving that the naval constructor is ignorant of steam and electrical engineering and therefore not qualified to take charge of the shops devoted to these branches at the navy yards. That nothing is further from the truth is shown by the following consideration of their training and experience.

In the first place the naval constructors are the pick of the Naval Academy graduates. They are selected from the highest numbers in their class, and, as a rule, have been taken from the first two or three. In making the selection in addition to their academic standing careful consideration is made of their general aptitude for the service as shown during their three or four years at sea, of their general officer-like qualities, and of their aptitude for the handling of men, and for general administration. The principle of selection is the same as is followed in the case of that other highly specialized and most efficient body of professional men, the corps of engineers of the army. After their education as line officers at sea the constructors are given at the famous Massachusetts Institute of Technology a post-graduate course in naval construction, which is the most thorough of any in the world.

Furthermore (and we cannot too strongly insist that the impression that the naval constructor is not a qualified steam engineer is absolutely erroneous) the course at the Massachusetts Institute of Technology involves also thorough instruction in steam and electrical engineering, during which the prospective constructors are given a course of practical training in the machine shops and laboratories of the institution.

The life work of the naval constructor will be done on shore and mainly at the various navy yards, and by virtue of his long residence at these yards, or as inspector at the various private shipbuilding yards, he gathers an ever-increasing and immensely valuable knowledge of the operation of these great industrial plants. Future promotion and distinction for him lie along these lines. There is every incentive for him to become thoroughly proficient.

With the line officer, however, into whose hands Mr. Meyer's plan would commit the construction of all electrical and steam machinery, and the management of the large and elaborate plants at the navy yards where this work is done, the case is entirely different. After his four years' course at Annapolis, the prospective naval engineer goes to sea with the expectation of spending practically all of his time afloat, and, naturally, his sympathies, interests, and above all his ambitions, will be connected with sea duty. An assignment for service ashore is merely a break in the routine of his chosen life work. If the line officer be an engineer officer, he will enlarge at sea his knowledge of the care and operation of a ship's machinery, but since by far the greater part of his time is spent afloat, his opportunities for becoming acquainted with the complicated and difficult work of managing such large industrial concerns as the steam machinery shops of the navy yards are, in the nature of things, very limited. His work is to run not to build, the engines, just as it is the work of the captain of the ship to run and not to build the hull.

Even when the line officer is ashore, his interests and future aims are still upon the sea, and, as a rule, he is only too glad when the next assignment for sea duty comes. *Proof of this is found in the fact that* during the past six years there have been at our seven leading naval yards, no less than 29 commandants and 41 captains of the yard. Evidently, the sea-going officer cannot too quickly get back to his natural sphere of service.

If there were available at the present time a corps of engineering officers who, like the naval constructors, had been *specially trained for shore duty in the management of the machinery shops*, etc. at the navy yards we would have more hope of the success of this particular part of Mr. Meyer's plan, but outside of a few of the older engineers, trained under the system which obtained before amalgamation no such body of men is available. Furthermore, it is our conviction that were such a body existent it would still make for economy and efficiency, if both hull and machinery were placed under the single management of a naval constructor.

That part of the Newberry plan which affected the navy yards was giving very promising results at the time Mr. Meyer took office. We have little doubt that his determination to separate hull and machinery was governed largely by certain alleged instances of incapacity of the naval constructors in their management of the machine shops which were supplied to the Secretary, most of them over the signature of the Engineer in Chief. The testimony before the House Naval Committee now before us however shows that a subsequent examination of these reported cases has elicited from the commandants of the various yards (all of them line officers) a complete disproval of the charges as made—a very gratifying vindication of the work of the naval constructors in this particular regard. We cannot but feel that with this later evidence before him, the Secretary will be disposed to reconsider that part of his otherwise excellent reforms, which proposes to separate hull and machinery and that he will allow the Newberry plan of a single management sufficient time to further demonstrate the economy and all-round efficiency of which it gave in the few months of its operation such great promise.

ELECTROLYTIC REMOVAL OF GREASE.

AN electrolytic method of removing grease from objects has been introduced in Germany. Grease can be rapidly removed from metallic objects by employing it as a cathode in a hot solution of potash or soda lye. It was supposed that the alkali metals set free at the cathode transformed the fatty matter into soap, but Barth has now shown that substances which cannot be saponified, such as machine oil, paraffine oil and paraffine, are removed very quickly by the current, and he explains this fact by mechanical action caused by bubbles of hydrogen which come off at the cathode. This action is produced only when the fatty matter is liquid. If the temperature of the bath is too low so that the grease is consistent, the removal is very slow and is incomplete. He operates with a moderately concentrated solution of carbonate of potash heated between 85 and 100 deg. C. As the anode he uses sheet iron or carbon pieces. When a piece of sheet iron covered with oil or paraffine is dipped into this bath it remains covered with oil ten minutes after immersion when the current does not flow, but upon sending the current all traces of oil disappear in a few minutes.

To permit two steamers to pass from the Wisconsin River to the Mississippi River, near Prairie du Chien, Wis., a railway bridge on the Chicago, Burlington, and Quincy Railway was raised by breakdown cranes a few weeks ago. There is no navigation on the Wisconsin River, but the two steamers were sent down to enter service on another route. The railway crosses the river near its mouth, and a 65-foot span was raised about 6 feet to clear the steamers' funnels.

ENGINEERING.

George W. Melville, Engineer in Chief of the United States Navy, states that there is every reason to believe that two ships of the navy will be fitted with the turbine reduction gear which we illustrated on the front page of our last issue. It is proposed to re-engine the "Baltimore" with turbines of 12,000 horse-power and equip one of the new colliers with turbines of 6,000 horse-power, both employing this reduction gear.

The number of persons killed in train accidents during the months of July, August, and September, 1909, as shown in reports made by the railroad companies to the Interstate Commerce Commission, was 193, and of injured, 3,752. Accidents of other kinds including those sustained by employees while at work and by passengers in getting on or off the cars, etc., bring the total number of casualties up to 20,093 (852 killed and 19,241 injured).

The Shoshone dam in Wyoming, which forms the leading feature of one of the projects of the Reclamation Service, has recently been completed. It is built of concrete, and measures 328.4 feet from foundation to the crest. It is 175 feet long at the top and 85 feet long at the bottom, where its thickness is 108 feet. The reservoir back of the dam, which has a capacity of 456,000 acre feet, will serve to irrigate 130,000 acres of land situated about 75 miles east of the Yellowstone National Park.

The grand total of canal excavation at Panama for the month of December was 2,811,681 cubic yards. This is 362,366 cubic yards more than the total for November, but 1,068,656 cubic yards less than the highest record made in March, 1909. Of the grand total, 1,455,611 cubic yards was dry excavation, removed principally by steam shovels. The dredges removed 1,356,070 cubic yards in addition to the amount pumped into Gatun dam by the suction dredges engaged on that work.

In recognition of the culmination of his life work in the discovery of the North Pole, the Senate has passed a bill making Commander Robert E. Peary a rear admiral on the retired list. This signal recognition of the explorer followed closely upon the recent gathering presided over by the Governor of the State of New York at which Peary received a gift of $10,000, which, by the way, he immediately contributed to the proposed American expedition for the discovery of the South Pole.

Major Mason M. Patrick of the United States army, speaking on the subject of the construction of an artificial island and additional fortifications near the entrance to Chesapeake Bay, drew attention to the fact that the two largest and fastest merchant vessels afloat to-day could each carry 10,000 men with all their munitions of war, and if unopposed, could land them on our coast in less than one week; and he also stated that more than one foreign power possesses a fleet of swift transports which can carry at one time over 100,000 men.

Secretary Meyer has asked for a large appropriation for the enlargement of the government drydocks to suit the huge battleships now under construction. He also asks for the construction of a $2,000,000 drydock at Norfolk, for an additional $1,000,000 for increasing the new dock at the New York navy yard to a length of 700 feet, for an additional $1,500,000 for increasing the Puget Sound dock to a width of 110 feet, and for the enlargement of the width of the Pearl Harbor dock, Hawaii, to the same width, at an increased cost of $450,000.

The new terminal station of the Pennsylvania Railroad Company at 33rd Street and Seventh Avenue, Manhattan, is so far advanced that it will be practically completed by the end of next month. The first service to be put in operation will consist of multiple-unit, standard size, electric trains running to Jamaica, Long Island, over a four-track road, which will soon be increased by the addition of two more tracks. This will be followed by the opening of the through express service to the West, which will be operated by the 4,000-horse-power electric locomotives illustrated in our issue of December 18th, 1909.

Were Jules Verne with us to-day, he would be greatly interested in two instances of rapid travel recorded during the past week. A traveler from London to San Francisco won a wager by covering the distance in two hours and thirty-five minutes less than ten days, the trip being made by the "Mauretania" to New York, the 20th Century Limited to Chicago, and the Overland Limited to San Francisco. A passenger from Lima, Peru, in making a hurried trip in response to a call to London, left Lima the same day by steamer to Panama, crossed by the Panama Railroad; made close connections with a steamer for New York; and caught the "Mauretania" for England. If the ship makes an average passage, the whole trip will have been covered in 19 days.

AERONAUTICS.

The first exclusively aeronautic show to be held in America is open at present in Mechanics Building at Boston. A score of full-sized representative aeroplanes of all types, together with a large number of models, are on view. Several competitions for models will be held, and some of the gliders and motor-driven aeroplanes may be tried out upon the ice of the lake in Franklin Field. This exhibition will give one a good idea of the state of aeronautics in the United States to-day.

On the 10th instant Wilbur and Orville Wright were presented with the Langley medals of the Smithsonian Institution by Chief Justice Fuller at Washington. Dr. Alexander Graham Bell and Senator Henry Cabot Lodge made brief addresses. Wilbur Wright announced that as soon as he and his brother got their American company under way they expect to devote their time to research work in aviation. The two gold medals were designed by J. C. Champlain, a member of the French Academy, the reverse being from the seal of the institution, which was designed by St. Gaudens.

Paulhan has expressed a willingness to fly in the vicinity of New York if Curtiss or some other interested person will have that injunction dissolved which now hangs over the heads of aviators using warpable planes or hinged wing tips. His brilliant success in California leads one to hope that his desire may be gratified in the interests of a sport of which the United States in general and the East in particular knows lamentably little. If Paulhan really gives an exhibition in these parts he will do much to stimulate New York's interest in aviation. The Hudson-Fulton flights were after all a fiasco, and yet they roused New York to an intense pitch of excitement. Paulhan ought to do better.

The first week of February the suit of the Wright brothers against Paulhan for an injunction restraining him from giving exhibitions in his Farman biplane was tried before Judge Hand in the United States Circuit Court in New York city. Judge Hand manifested great interest in the case and his decision is awaited with interest. It is uncertain whether he will grant a preliminary injunction as Judge Hazel did at Buffalo last December. In defending the attack of the Wrights upon the Bleriot monoplane Mr. E. R. Newell asserted that Prof. S. S. Montgomery's patent which antedates the Wright patent, covers the same system of plane warping as the Wrights themselves claim, and he further says that the machine as built to-day does not correspond with the patent. A full report of the Wright-Curtiss case and the text of Judge Hazel's decision appears in the current SUPPLEMENT.

As soon as he had finished flying at Los Angeles, Charles K. Hamilton went to San Diego where he made a number of daring flights with his Curtiss biplane. On January 23d, after starting from the vast plain near the Hotel Del Coronado Hamilton twice flew out over the ocean so far that he disappeared from view for ten minutes. When he reappeared he came from a different direction. In the first flight he covered about 10 miles, and in the second one 15. The wind was blowing at times as high as 20 miles an hour. After circling upward to a height of about 800 feet Hamilton stopped his motor and made a wonderful long straight glide to earth. This is probably a record performance, certainly the longest glide ever made in America. A week later at Bakersfield, Cal., he made two excellent flights under difficult conditions. Starting from a half mile track, he flew about the town and out over the desert and adjoining oil fields, finally landing successfully at the starting point. His mastery of the biplane seemed complete.

Subsequent to the Los Angeles aviation meeting M. Paulhan made excellent exhibition flights at San Francisco, Denver, and New Orleans. At San Francisco on January 24th he made several flights in a strong wind the last and highest of which of 12 minutes duration, was made after sunset. Two days later he rose to a height of 1,300 feet in a flight of 31 minutes' duration. On February 1st, at Denver, he was mobbed by a crowd of 30,000 people eager to see him fly. After three preliminary attempts, he finally left the ground and made two circuits of the course at Overland Park. The next day he made a 15-mile cross-country flight in a driving snow storm. In starting, he ran his Farman biplane through snow three inches deep, and when he alighted, the planes and struts of the machine were in many places covered with snow, while Paulhan himself was suffering from the bitter cold. Previous to this long flight, he made a preliminary flight of 8 miles. On February 4th after circling the Park successfully a dozen times, Paulhan twice was unsuccessful in starting in the distance at his disposal. The first time one of the wheels of his machine struck the fence and was knocked off while the second time the machine crashed into the fence and was demolished. Paulhan was unhurt, but several spectators were injured.

SCIENCE.

The American Museum of Natural History in New York city has commissioned William Couper to model a statue of Commander Robert E. Peary for the Museum. The statue is to be life size and of marble.

In a bulletin issued by the United States Department of Agriculture Mr. Ned Dearborn writes on methods of destroying English sparrows. The evidence of the destructiveness of the sparrow is overwhelming, for which reason some means should be adopted to check the spread of the bird. Mr. Dearborn recommends the destruction of the nests from two to twelve days throughout the breeding season. Thus the number of English sparrows could be reduced without resorting to shot, poison or traps.

The Smithsonian Institution has received a letter from ex-President Roosevelt dated December 15th, 1909, from Nairobi informing the secretary of that institution that his expedition has finished its work in British East Africa. The collections made in that country aggregate 8,463 animals which include mammals large and small, birds, reptiles and batrachians, fresh water and marine fish. Considering the fact that probably over 95 per cent of these animals find their duplicates in the natural history museums of this country and of Europe ex-President Roosevelt seems to have been doing much unnecessary killing.

The Radium Institute of America has been incorporated. Its purposes are to study radium and radio active substances, rays, and emanations in the interests of science and humanity and to maintain a chemical laboratory, library, meeting room and offices and to acquire and hold patents and licenses to deal in radium and properties pertaining to radium. The headquarters of the institute will be located in New York. The twelve incorporators are Dr. Robert Abby, Dr. Nicholas Murry Butler, Charles F. Chandler, Bergen Davis, William J. Gies, William Hallock, Ellwood Hendrick, Hugo Lieber, Dr. Willy Meyer, George B. Pegram, Hugo Schweitzer, and Edgar F. Smith of the University of Pennsylvania.

An expedition to observe and photograph Halley's comet from the Hawaiian Islands is to be sent out by the Astronomical and Astrophysical Society of America. In view of the possible perturbations arising from the close approach of the comet to the earth on May 1st and to Venus on May 16th to 18th meridian observations are especially desired during the period in which the comet is sufficiently bright for that purpose. The close approach of the comet to the earth will afford an unusual opportunity for a study of the physical condition of comets. The comet's close proximity to the sun at the time of maximum brilliancy imposes serious limitations upon the Society's programme. Widely extended co-operation will be required throughout the whole world if a continuous photographic record is to be even remotely realized.

The American Museum of Natural History has been presented with a life-size marble statue of Morris K. Jesup by J. Pierpont Morgan, Henry Fairfield Osborn, Cleveland H. Dodge, Charles Lanier, J. Hampden Robb, Joseph H. Choate, and others. At the unveiling of the statue addresses were delivered by Prof. Osborn (who succeeded Mr. Jesup as president of the Museum), Mayor Gaynor and Joseph H. Choate.

Commander Robert E. Peary has contributed $10,000 to a fund for the equipping of an American expedition to the South Pole. The check for the amount of his contribution had been handed to him by Gov. Hughes on behalf of the people of New York as a testimonial of appreciation of his achievement in finding the North Pole, and the Metropolitan Opera House was crowded with people who had come to take part in what the fostering Civic Forum called a "national testimonial" to the explorer.

There is a gaseous element discovered in the atmosphere by Ramsay which is remarkable for its chemical inertness but though destitute of chemical properties it possesses a very curious physical property which was discovered by J. Norman Collie. When a sealed glass tube containing mercury in an atmosphere of neon at low pressure is shaken it becomes strongly luminous. Similar effects are obtained when other gases are substituted for neon but the light emitted by neon in these conditions is especially bright. If the shaking is repeated at intervals during two or three hours, the intensity of the light diminishes for a time and thereafter remains constant. The original luminosity can be restored by passing an electric discharge through the tube. If one end of the tube is heated to 750 deg. F. while the other end is cooled by immersion in liquid air and the tube is then allowed to return to the ordinary atmospheric temperature the part which has been heated glows much more brightly than before. The luminosity is also greatly increased by substituting a tube of fused quartz for the glass tube. G. Claude is endeavoring to utilize this remarkable property of neon as a source of light and claims to have constructed neon lamps of an efficiency equal to about 1 watt per candle power.

DID GREAT BRITAIN HAVE THE FIRST "DREADNOUGHT"?

THE "ROYAL SOVEREIGN" OF 1862

BY PERCIVAL A. HISLAM

The SCIENTIFIC AMERICAN for November 20th, 1909, contained a description by Mr William Boerum Wetmore of the U S S "Roanoke" a converted steam frigate, which he claimed to have been the original prototype of the "Dreadnought" The date of the conversion of the "Roanoke" from the frigate into the three-turreted ironclad was 1863 but England, the birthplace of the twentieth century "Dreadnought," has a similar instance to the "Roanoke," but which dates from the previous year—1862

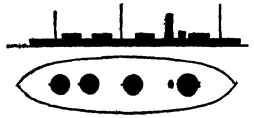
The "Royal Sovereign" as this ship was named, was built as a three-decked sailing ship of 3,144 tons and 120 guns and in 1860 had been fitted with engines of 800 horse-power The sides of the "Royal Sovereign" after conversion were composed of three feet of solid timber strengthened internally with diagonal iron bands and clothed externally to some distance below the waterline with $5\frac{1}{2}$ inch rolled armor plates One inch iron plating was laid upon the deck beams, and over the iron plating was laid the deck proper, consisting of 6-inch and 8 inch oak planking From the sides of the ship the deck sloped upward to the outer circumference of the turrets, which thus appeared like circular forts on the apex of a glacis.

The following description is taken from a contemporary account in the London Times newspaper "Stepping on the 'Royal Sovereign's' upper deck, we find that her light iron bulwarks, 3 feet 6 inches in depth are thrown down outward on hinged stanchions. On the crest of the deck stand the four turrets and pilot house, funnel casing, hatchways, and ventilating shaft. The foremost turret standing five feet above the deck, has its top covered by a grating, and is surrounded by a handrail, and thus affords a deck promenade for the officer of the watch or lookout man The single-gun turrets are 4 feet 3 inches above the deck'

It was claimed at the time that the method of mounting and working the guns in the "Royal Sovereign" was superior to anything which had then been applied in any American turret ship In American designs the turret rested upon the upper deck, and was thus liable to easy disablement, but in the English vessel the base of the turret was on the lower deck, and the citadel was therefore much less likely to be disabled by a hit. The American method resulted in the turret being nine feet above the deck while in the "Royal Sovereign' only five feet or four feet three inches, as the case might be, was exposed to the enemy's fire. Further, the latter ship's turrets could be worked by rack and pinion inside the turret, by the same method from the outside, and by handspikes worked like capstan bars, as well as by steam

It will be seen that the "Royal Sovereign" had four turrets—one more than the Roanoke", but she had one gun less, for while the foremost contained two guns, the others had only one each All the turrets were mounted on the center line of the ship, and the guns were muzzle loaders of $12\frac{1}{2}$ tons firing a 300-pound shot.

The original speed of the "Royal Sovereign" had been 12 25 knots, but after conversion this fell to 11, a difference which was fully accounted for by the increased immersion of three feet Her freeboard re-



Converted British three-decker "Royal Sovereign" changed to an all-big-gun battleship in 1862

WAS THIS THE FIRST "DREADNOUGHT"?

mained at seven feet after conversion The cost of the work was $699,900

The "Royal Sovereign," besides having been, at any rate, one of the prototypes of the modern 'Dreadnought,' is interesting as having been the first vessel in which the turret principles of Capt Cowper Coles were put into practice The first vessel actually built in England embodying those principles was the "Captain," an ironclad of 4,272 tons, which capsized in the Bay of Biscay on September 6th, 1870

According to contemporary accounts, the speed of the Roanoke" was only 5 knots This is inferior to the Royal Sovereign's" speed by 6 knots The latter vessel again, had four turrets to the 'Roanoke's" three, both ships had $5\frac{1}{2}$ inches of side armor in a rolled plate although up till then most American ships had been armored on the inferior laminated system, both ships were practically mastless, for the three poles of the "Royal Sovereign" reached only just above the top of the funnel In freeboard there was little to choose between the two, while in the method of placing the turrets the British ship was decidedly superior

Much, therefore, as we owe to America in the development of modern navies, and more especially, perhaps, in the introduction of steam navigation and in the correct placing of turrets in modern battleships, I think it must be admitted that Great Britain was the first to possess a prototype of the modern "Dreadnought."

I have been unable to procure a picture of the "Royal Sovereign" for reproduction, but the accompanying elevation and plan will convey an idea of the appearance of the ship.

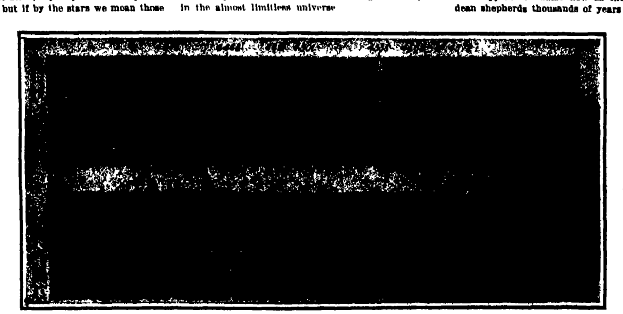
It may be mentioned that Russia launched in 1867 the "Admiral Lazareff," a three-turreted ironclad of 3,754 tons, very similar in general design to the "Roanoke." She carried in each turret two $15\frac{1}{2}$-ton guns, but it was seen fit later to alter this to one 11-inch for each In view of the diagonal (or echelon) arrangement adopted in the British "Dreadnought" cruisers of the 'Invincible" type, it is interesting also to note that Italy led the way with this system of mounting with the "Duilio" (1876), Great Britain following with the "Inflexible" in 1881, and with four other ships a few years later The only American examples of this system of mounting were seen in the "Maine" and 'Texas," the first with two 10-inch and the second with one 12-inch gun in each turret.

The arrangement of the turrets in the British 'Dreadnought" had a prototype in the French "Admiral Duperré," launched in 1879 This ship had two turrets on the center line and on the same level aft, and a turret on each beam just forward of the funnels. The guns had a freeboard of 27 feet 5 inches, giving them a great command of fire Each turret contained one gun of 13 5 inches caliber, and if another center-line turret be added forward of the two beam turrets, it will be seen that the arrangement of the 'Dreadnought" is almost exactly reproduced It is strange how often we are confronted with the fact, in reading old books and other records, that there is "nothing new under the sun"

OTHER WORLDS IN SPACE

BY PROF. S. A. MITCHELL, COLUMBIA UNIVERSITY

If one should look at the heavens on any clear moonless evening, he would see them shining with countless orbs of light apparently millions in number It is a fact that from our earliest education we have regarded the terms "numberless as the sands of the seashore," and "countless as the stars," synonymous with quantities almost infinite, but if by the stars we mean those that can be seen by the naked eye (and the expression originated thousands of years before the invention of the telescope), our ideas have been utterly at variance with the truth The unaided eye cannot see millions of stars as is commonly supposed, nor yet hundreds of thousands for at any one time we could count only two to three thousand separate stars, and in the whole heavens there are less than six thousand which can be seen with out a telescope. A small glass, however, increases this number largely, and with greater and greater telescopes more and more stars are brought to our ken It is estimated that the astronomer of to-day can see and photograph upward of a hundred million of stars. Each of these is a sun shining by its own light, the new astronomy tells us that thousands of these suns have systems around them possibly resembling our own solar system, and it is not outside the bounds of probability that many of the planets about these distant suns may be inhabited by people who live and move and think Indeed, this earth of ours, of so much importance to us, is a most insignificant speck in the almost limitless universe



PHOTOGRAPHS OF THE SPECTRUM OF μ ORIONIS, JANUARY 5th AND 8th, 1906.

The upper spectrum shows a velocity of 25 miles per second away from the earth, and the lower one of 48 miles per second in the same direction.

Astronomers by their meridian circles have been able to measure the exact positions of these distant so-called "fixed" stars, and have come to the conclusion that in spite of their names, there is none of them absolutely fixed in space, i e, without motions. The movements of these heavenly bodies at the enormous distances we are from them are however very small, and the changes of position in the sky so slight from year to year that they could not be found without the most careful measurements So from this point of view the stars are fixed, and the constellations appear the same now as they did to the Chaldean shepherds thousands of years ago Still the motions are there none the less The old astronomy was able to measure motions athwart the sky, at right angles to our line of vision, the new astronomy is able to supplement this by a knowledge of their movements toward us or away from us in the line of sight. The revelations of this new branch of astronomy are revolutionary in their importance, and of the greatest moment to our ideas of the universe as a whole

The principles underlying the use of the modern spectroscope applied to the stars are given in SCIENTIFIC AMERICAN, December 29th, 1906. There is required for this purpose a powerful telescope, and a most accurate spectroscope attached, whose temperature must be kept absolutely uniform during the two or three hours that may be consumed while the photo-

(Continued on page 179.)

CONCRETE CONSTRUCTION ON THE PANAMA CANAL

HOW THE EIGHT MILLION CUBIC YARDS OF CONCRETE IS HANDLED

To the untrained eye the work which has hitherto been done on the construction of the Panama Canal necessarily appears more or less confused and chaotic Although over one-half of the excavation has been completed, very little if any of the prism of the canal has been excavated to its finished dimensions, and the outline of the completed work is therefore irregular and ragged

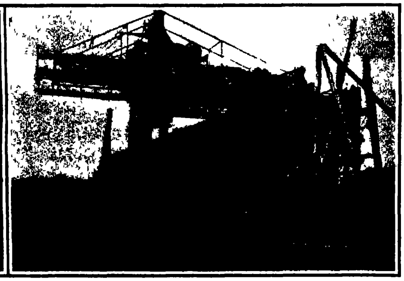
Some few months ago, however, the work of putting in the permanent concrete structures began, and from now on this great work will begin to take on definite shape and present visual evidence of its massive and permanent character

The masonry works will not only be the largest of their kind ever built the locks and spillways being on a scale of unprecedented proportions, but these works in the aggregate will probably represent the largest mass of masonry of any kind whatsoever hitherto placed in a single engineering work of magnitude It is questionable whether an exception would have to be made even in the case of some of the famous masonry aqueducts built in ancient times, and the Pyramids or the Great Wall of China are not to be seriously reckoned in comparison with difficult hydraulic works of the character of those on the Panama Canal In the accompanying series of photographs, which were recently taken on the Isthmus, one is able for the first time to gain some impression of the massive character of the concrete and reinforced-concrete structures the construction of which is now proceeding with gratifying rapidity

The concrete work embraces six huge locks, three at Gatun on the Atlantic side of the Isthmus, one at Pedro Miguel and two at Miraflores on the Pacific side, and the great spillway in the center of the Gatun dam for carrying off the surplus waters All of the locks will be 110 feet wide by 1,000 feet long with a depth over the sills of 45 feet. The three locks at Gatun will form a continuous structure which, with the piers forming the approaches at each end, will have a total length of 3,800 feet, the whole work forming one huge monolithic mass of concrete The Pedro Miguel lock with its piers will be 1,800 feet, and the two locks and piers at Miraflores will have a length of 2,800 feet Into the construction of these locks will enter about 8,000,000 cubic yards of concrete, and of this 900,000 tons will consist of cement The spillway through the Gatun dam has been cut through a low

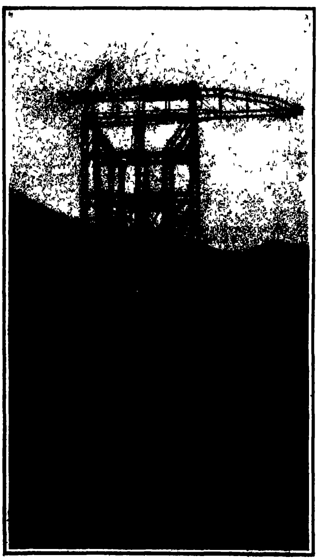
Note the wooden forms in which the walls are molded

Building concrete side wall—Gatun Spillway.

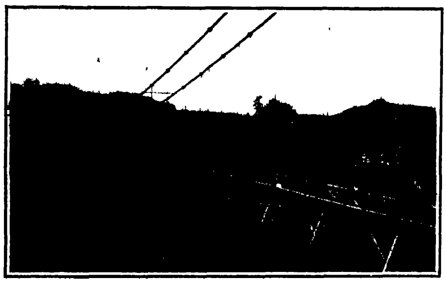


Millions of tons of sand are handled for the concrete

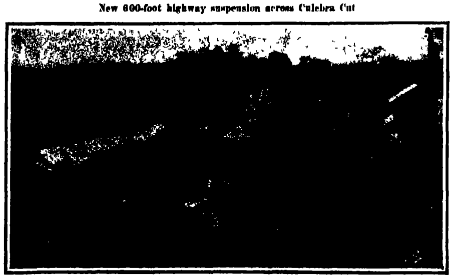
Sand cranes and pockets at Balboa



Huge cantilever crane for placing concrete at Pedro Miguel locks.



New 600-foot highway suspension across Culebra Cut



Stone for the concrete is brought from twenty miles east of the canal.

The stone crushers at Balboa.

CONCRETE CONSTRUCTION ON THE PANAMA CANAL.

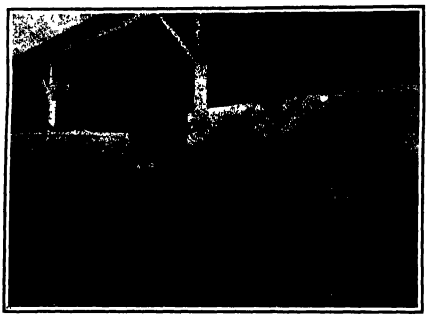
hill situated at about the center of the dam, and with in the excavation thus formed is now being laid the deep concrete flooring, the massive retaining walls and the piers between which will swing the gates for regulating the height of the water in that great artificial inland sea which will be formed by the dam

It can readily be understood that the economical and expeditious laying of 8 000 000 cubic yards of concrete in structures of this magnitude called for a special plant of great size and capacity At Gatun about 4,000 000 cubic yards of concrete will be employed The crushed stone the sand and the cement for this concrete is handled in the following manner The crushed stone comes from Porto Bello a small hamlet about 20 miles east of Colon along the Atlantic coast The rock is taken from the quarry by steam shovels and sent by gravity to the giant crushers, and thence by gravity to the barges in the harbor From this point it is carried to Cristobal at the Atlantic entrance to the canal and thence via the old French channel, to the docks at Gatun Here it is unloaded into storage bins by giant grab buckets, operated from cableways suspended between two sets of towers on either side of the channel

The sand is brought from Nombre de Dios, about 40 miles along the coast from Colon It is taken from the sand pits by clamshell buckets, loaded into steel barges and taken to Gatun, where it is unloaded by a process similar to that of unloading the crushed rock The cement is now being shipped from New York At Colon the cement is transferred to barges and taken *via* the old French channel to Gatun and unloaded to the storage yards The rock and sand storage piles have a capacity of about 300 000 cubic yards, while the cement yard accommodates about 100,000 barrels From these storage buildings, the rock, sand, and cement are delivered through valves to charging cars running underneath These cars, which are electrically operated, carry the materials to the concrete mixing machines located nearer the locks' site and discharge it direct to the machines After the concrete is mixed, it is dumped into buckets set on flat cars, and the cars are run to position under the wide cableways spanning the locks' site and from these cableways the buckets filled with concrete are swung to position on the locks under construction

The general principles upon which the plant at the locks on the Pacific side is designed are the same as those employed at Gatun, the mechanical details have been varied to meet the local conditions

The latest report of the work, namely, that for December last, shows that during the month the total work of excavation amounted to 2,618,662 cubic yards and that the total canal excavation of all kinds amounted to 2,811 681 cubic yards The material placed in dams, mainly at the Gatun dam amounted to 340,610 cubic yards, and during the month 57,265 cubic yards of concrete were built up in place



The sluiceways, etc., for rapidly emptying and filling the locks are of unusual size.

WOODEN FORMS FOR GATUN LOCK CONDUITS.

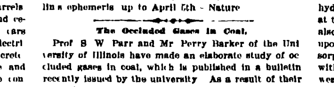
HALLEY'S COMET

Some interesting measures of Halley's comet, made with the micrometer of the Yerkes 40-inch refractor, are published by Prof Barnard in No 605 of the Astronomical Journal With this large telescope the comet was quite an easy object, and the measures should be good, but, as Prof Barnard suggests, the edges of such a nebulous body are not easy to set on

The measures extend up to November 30th, 1909 when the estimated magnitude was about 11 0, and the comet showed a condensation of some 7 inches diameter The diameter of the whole object was 41 inches, and possibly an ill-defined nucleus was seen, but this feature was very doubtful From September 17th to November 14th the measured diameters reduced to miles ranged from 16,400 to ' 200 miles the mean being 12,800 miles, or about 1½ times the earth's diameter

At the December 1909 meeting of the Royal Astronomical Society reported in No 418 of the Observatory the Astronomer Royal announced that a photograph secured with the Reynolds reflector at Helwan, on August 24th shows the comet's image, its position agrees within 0 12s in R A and 1 7 min in declination with the position calculated from the Cowell Crommelin orbit corrected by the Greenwich observations Messrs Keeling and Knox Shaw are to be congratulated heartily upon securing the first known photograph of the comet In No 26 of the Gazette astronomique, Signor Pio Emanuelli discusses the probable encounter between the earth and the comet's tail in May next At 10 A M (G M T) on May 18th the comet will pass the descending node of its orbit, while the earth will pass the same point eighteen hours later For an encounter between the tail and the earth to take place, it is shown to be necessary that the latter should be 22,100 000 kilometers (13,732,277 miles) long and that its breadth should be such that it extends, from its axis earthward, 400 000 kilometers (2 485,550 miles)

The accompanying chart shows approximately the apparent path of the comet, according to Mr Crommelin's ephemeris up to April 5th - Nature



APPARENT PATH OF HALLEY'S COMET FROM JANUARY 5th TO APRIL 5th.

The Occluded Gases in Coal.

Prof S W Parr and Mr Perry Barker of the University of Illinois have made an elaborate study of occluded gases in coal, which is published in a bulletin recently issued by the university As a result of their work it seems that two active processes are set up immediately upon the liberation of the coal from the vein The first is an exudation of hydrocarbons, mainly consisting of marsh gas (CH_4), the second is an absorption of oxygen There can be little question, moreover, that the alterations proceed simultaneously There are present in the gases from all the samples of fresh drillings, notable quantities of methane, ranging from 18 per cent to 86 per cent of the various gas volumes. At the same time the oxygen present drops in a very positive manner, in some cases even reaching the vanishing point. That this transpiration of gases is interdependent and is of the nature of an osmotic exchange can hardly be affirmed as an explanation of the phenomenon On the contrary, there seems to be evidence that the gases operate independently of each other

In the case of samples of marsh gas the exudation of CH_4 seems to have spent itself in those samples held in laboratory containers for two years. In no case is there evidence of further liberation of this gas, even with thorough application of the vacuum An evacuation of the gases from two-year-old samples shows no marsh gas present. The completion of this exudation would seem to be reached after two months, though it is well to note that by forcing, as with a vacuum, the two-months-old sample may be made to yield more methane, though in relatively small quantities. On the other hand, the avidity of the coal for oxygen seems to be pronounced at the very beginning of the exposure of the freshly-mined material, and while there are a number of cases where a certain agreement seems to exist between the in-going and the outgoing marsh gas, still there are more cases where the absorption of oxygen is pronounced without any evidence of marsh gas being present. In all cases the oxygen nitrogen ratio shows a positive diminution of the oxygen from the normal ratio of approximately 1 to 4 with practically no evidence of marsh gas being present It seems fair to conclude, for the present, that there is no necessary connection, at least of a strictly chemical nature, between the exudation of marsh gas and the absorption of oxygen

Again, the liberation of CH_4, while very active in the first few days after removal of the coal from the ground, diminishes in amount quite rapidly till, after the second month, there is very little of this gas in evidence The activity of the coal for oxygen, on the contrary, seems to be of longer duration Samples collected June 1st, 1906, were tested in May and June 1908 There is marked absorption of oxygen in the sample after two days' exposure in the flask to normal air, while in a second, with five days' exposure, a still further reduction in the oxygen ratio without accompanying evidence, also, it should be noted, of marsh gas, was obtained A marked avidity for oxygen was shown after two years from the time of collecting

These facts have a direct bearing on the topic of deterioration as substantially defining the limit as to time of that form of alteration While varying somewhat in different coals, the loss of hydrocarbons for the most part is practically complete at the end of two months These facts have a bearing also upon the matter of weathering, and indirectly upon the matter of spontaneous combustion The absorption of oxygen is undoubtedly closely associated with both of these phenomena The studies upon the weathering processes coincide with these studies in gases, namely, that in all probability this low type of oxidation extends over an indefinite length of time Moreover, while under normal conditions there is effected but a very slight oxidation and loss of fuel values, the conditions are favorable, as, for example, for bringing about a very rapid combination with oxygen upon an increase of temperature

How far this absorption of oxygen is a chemical reaction, or low combustion resulting in CO, and H_2O, and how far an absorption into the molecular structure and composition of coal must be left for study

Dying Pearls.

In the Museum of the Louvre in Paris lies a collar of pearls at the point of death! Its deathbed is a plaque of velvet, and it is the large collar that was part of the personal estate of Thiers and once belonged to his wife It is simply set and has no artistic value, its material value, however is estimated at $60,000 It consists of 145 pearls in three rows, the total weight of which is 2,097 grains, the three largest pearls of the collar weighing 36, 39, and 51 grains respectively. This collar must "die", every day it loses another degree of its luster, and in the course of the present decade it will become as dingy as a much-worn wreath of roses

Why? Because pearls keep their incomparable sheen only when worn by women and come into habitual contact with the gentle, soft, and warm skin of the wearer When, for instance, Queen Augusta died it was found that her magnificent strings of pearls were likewise in a persistent decline, and for the reason, indeed, that for many years she had not worn them on her bare neck (which fact was explained by her age) but only around the fabric of the neck of her waist. At that time a treatment of baths in sea-water was prescribed for them by experts, and for several months, under obvious necessary precautions, they were sunk into the sea and thus recovered their old luster

When, for instance, a collar of pearls is taken from the neck, where, subject to a temperature of 40 deg C. approximately it has lain for hours, and is laid upon the marble plate of the dresser, which is perhaps only 20 deg. C warm, it feels, so to speak, a

(*Concluded on page 172.*)

Correspondence.

MR. RIEDERER'S PROBLEM.

To the Editor of the Scientific American

Your correspondent who replies to my problem certainly has not studied the question very closely There is absolutely no doubt as to the possibility of the solution for taking any single number, it is quite evident that the remaining 14 numbers will make 7 pairs, each one of which with the taken number forming a different combination of three What one number is capable of doing, every other is likewise. So that certainly proves that 7 combinations as told are possible The question is, how can this or any other similar problem be worked out without a haphazard shifting till you get the solution?

Find the system The problem is all right

New York city Herman S Riederer, Ph D

OBSERVATIONS OF A METEOR IN FLIGHT

To the Editor of the Scientific American

I have seen no mention in the newspaper of the meteor that fell west of Corrington, North Dakota, on January 16th. It was seen for seventy miles south of Streeter, North Dakota and passed over us with great speed. It buried itself six feet in the ground about seventy miles north of Streeter The heat produced was so great that for forty-eight hours no one could approach it closely notwithstanding the fact that the ground was covered with snow and was frozen to a depth of four feet When the meteor passed over our heads from a southwesterly direction to northeast, it shone most brilliantly The noise which it produced can be likened only to that of a very large cannon ball in flight The diameter of the meteor is 56 inches It has been taken out and sent to Bismarck J J Rott

Streeter, N D

SOME STRANGE ANIMAL INSTINCTS.

To the Editor of the Scientific American

Two items in your science column of January 8th, 1910, interest me That about the return home of the kitten and cat because there are scientists in your own city and elsewhere who have held doggedly that the special sense of this wonderful ability to go back home is not a special sense but the result of some sort of observation, although the cat may be blind folded They even claim that homing pigeons find their way back by observing 'the lie of the country' While this instinct is by no means unerring, and is developed to a much greater extent in some individuals than in others, there seems no justification of the denial to these lower creatures of a faculty of orientation or traversing which man possesses in only a small degree There are many instances where the return has been made over a route very different from that of the outgoing journey and could not have been influenced by the topography, even if it could have been observed

The other instance is that of the magpie which was fond of rubbing tobacco and its ashes into its plumage as mentioned by the writer in Kosmos This is of special interest to me because I had made a similar observation on a bluejay—a relative of the magpie—and had never so far been able to confirm it from any other source Fortunately as long ago as 1896 I recorded it in my little book "The Story of the Birds" (Appleton) from which I venture to quote

"I saw him (the jay) engaged in the walnut tree one day in late summer in a manner that made me fear that his bath had not been sufficiently effectual He would pluck off a leaf, lift his wing and rub it into his plumage I saw him do it repeatedly, and since walnut trees have a pungent odor and are disagreeable to insects, I feared that he had some guests that he was trying to get rid of If this theory should be correct here was a case of a bird using perfumes with at least good intentions" (Page 243)

It is well known that dogs and other mammals will rub their bodies into or against something that is strikingly odorous, for the sake of the perfume only in which they seem to delight, but these two are the only instances that I know of where birds are recorded as doing the same. It would be interesting to hear from any other instances—if there are any, as is likely James Newton Baskett

Mexico, Mo

RE-ARMING OUR WARSHIPS.

To the Editor of the Scientific American

In a letter to the Scientific American of September 5th, 1908, a correspondent, Mr A B Wingfield, suggested the re-arming of our "Connecticut" class of battleships with four 12-inch guns in place of the eight 8-inch that are now carried in the main battery of this type. The Editor's comment at the time was that the greater weight of 12-inch gun emplacements on the beam would necessitate too costly structural strengthenings to justify the change, that the 6-inch armor protection would be too light for those emplacements, and that the increase in dead weight would sink the already low armor belt even lower in the water A previous letter appeared in your issue of August 15th, 1908, and since then changes of this character have been under consideration

I know that if the Scientific American takes up this matter, its influence will be brought to bear on naval men, the object in view, of course, being to make dreadnoughts of the "Connecticut' type and semi-dreadnoughts of the 'Georgia" class. The younger officers in the navy whom I have questioned in regard to this matter are unanimously in favor of these improvements.

As armed at present, the "Connecticut' and "Georgia' classes are not as efficient as a comparatively small additional expense could make them, and in view of the conceded superiority of the all big gun type of ship, it seems worth while to consider how it would be possible to so reconstruct the above types as to make them more formidable against dreadnoughts.

The pre-eminent function of a battleship is to concentrate the greatest efficiency and power possible in a single vessel The armament of the "Connecticut" class consists of four 12-inch eight 8 inch, 12 7-inch, and twenty 3 inch, of which four 12's, four 8's, six 7's and eight 3's can fire on broadside The "Georgia" type mounts four 12 inch, eight 8-inch, twelve 6-inch, and twelve 3 inch, of which four 12's six 8's, six 6's, and six 3's fire on broadside Now to convert these ships to dreadnoughts it would be necessary to mount one 12 inch gun in place of the two 8's in each of the beam turrets keeping the emplacements as they are

As the 7 inch guns are too small for battle ranges and too slow for torpedo defense they could be substituted by the 5-inch rapid fires which are now being mounted on all our new dreadnoughts. With say eighteen of these and a few more 3 pounders in place of the present twenty 3 inch guns, the change is complete and you have a vessel the equal of the "Michigan' type which are really powerful dreadnoughts on a "Connecticut' displacement

In the "Georgia' class the same renovations could be made, except that the four superposed 8's would have to be retained and the six additional 6's omitted The 'Idaho' and "Mississippi" could be similarly treated Under this arrangement the armament of the two classes would now be "Connecticut' eight 12 inch and eighteen 5-inch with a broadside fire of six 12's and nine 5's "Georgia" six 12 inch, four 8 inch, and twelve 5-inch with a broadside fire of five 12's, four 8's, and six 5's Then our two 'Idahos, four 'Georgias," six "Connecticuts" two 'Michigans" and two "Delawares" would mount 124 12 inch guns instead of 84 as at present, and would practically be a dreadnought fleet The benefits from these changes are as follows

1 A homogeneous broadside giving greater concentration of fire at battle ranges

2 A simpler system of spotting and fire control, with only one range to get and only one caliber of gun (excepting the four 'Georgias") in the main battery

3 A greater efficiency of ordnance resulting from more uniformity in ammunition and consequent speed in handling

4 A better organization for and the quicker delivery of shell

5 An opportunity offered to hold former 7 inch gun crews in reserve for turret crews

6 The elimination of unwieldy and inaccurate middle batteries with large crews necessary to their service in exposed positions

7 A smaller number of men in action at the same time and behind heavier armor (i e, turrets only) at battle ranges

8 An increase in the efficiency of torpedo defense by a gun more practicable in every way than the old caliber, which was ineffective at 3 500 yards and required the same number of men to handle it

9 The lightening of the armor belt and bringing it higher out of the water, where it belongs

10 The placing of the entire main battery behind turret armor

Now as to the cost For one battleship of the "Connecticut" class to be improved as shown above, the expense would consist chiefly of the price of four 12 inch and eighteen 5-inch rifles, and the remodeling of the 8-inch turrets and handling rooms The 5-inch guns could occupy positions behind the old 7 inch barbettes, on the gun deck the 3 inch casements (slightly enlarged) on the main deck and new mounts for the superstructure I do not believe that the structural part of the ship would need strengthening in any way Moreover, all these discarded eights, sevens, sixes, and threes could be mounted on smaller cruisers, where they could do the work required of them, and thus money on new construction could be saved

I think that you will agree with me in saying that with these improvements made our pre-dreadnought type will not only possess far greater efficiency than they do now, but also that they will be able to stand in the first line of battle with future dreadnoughts The real question is this Is this greater efficiency worth its cost? In view of the slight difference in the cost of maintaining in commission a "Connecticut" and a "Delaware," I think it is and the Scientific American can do a lot toward making these paper changes realities. Harold M Kennard

Brooklyn, N Y

[In publishing this interesting study of a much mooted question, we would point out that it seems to be the unanimous opinion of naval men in all navies that the re-arming of the older ships does not pay, that all appropriations for construction should be put into new ships. Such changes as are suggested above would involve enormously costly structural work on the hulls There is no room for 12 inch guns in the 8 inch turrets —Ed]

The New Supplement Catalogue

The publishers of the Scientific American have issued a new catalogue of the Scientific American Supplement in which 20,000 articles are listed Many of these articles have been translated from foreign publications which are ordinarily inaccessible to English-speaking readers Many of them also are papers read before the learned scientific societies of the world and accessible only in a few large public libraries The articles are all carefully indexed so that the best information on any particular scientific subject may be found in a few minutes. The catalogue will be sent gratuitously to all who apply for it

The Current Supplement.

The current Supplement, No 1781 contains some remarkable pictures of the Seven Wonders of the World, together with a good article on them "The Practical Utilization of Insect Parasites" is the title of an article which will interest the farmer Another installment of the Munroe and Hall paper on "Combustion and Explosion, a Primer on Explosives for Coal Miners' is published Some new uses of paper are described Mr D A Arthur contributes an article on Chinese calendars Since the Chinese have just celebrated their new year, this article comes out with particular timeliness H A Humphrey's paper on an internal-combustion pump is concluded Leonardo da Vinci, perhaps the only truly all-around genius of the world, is the subject of an excellent article by Edward P Buffet The Wright injunction is summarized and illustrated

Comets Due to Return This Year.

In addition to Halley's, two other comets are due to pass through perihelion this year The first is known as Tempel's second periodical comet, discovered in 1873 July 3rd at Milan Its period is about 5¼ years, and it was re-observed in 1878, 1894, 1899, and 1904, making its perihelion passage, on the last occasion, in November, it should therefore return this coming spring D'Arrest's comet, discovered in 1851, is the second object, and is due to return during the summer of this year Its period is about 6½ years and it was re-observed at its return in 1857, 1870, 1877, 1890 and 1897 but it escaped observation, being unfavorably placed, in 1903

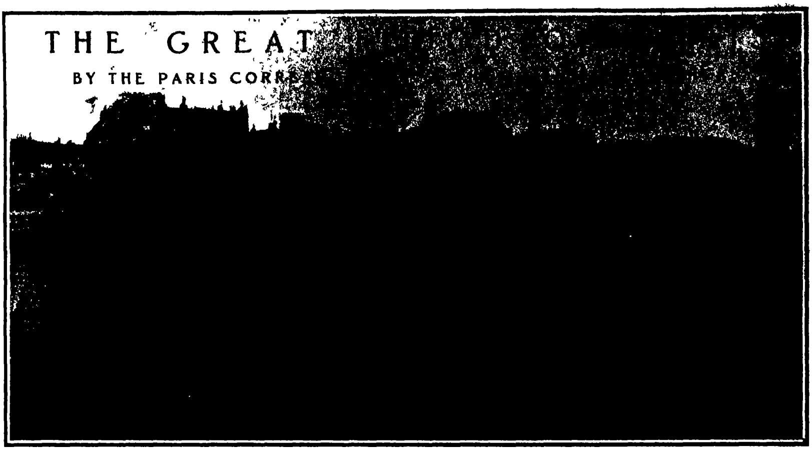
Mr Lynn, who gives these particulars in No 418 of the Observatory also recalls some of the historic occurrences which have coincided with the returns of Halley's comet.

The Scientific American Fourth Dimension Book.

The readers of the Scientific American have hardly forgotten the Scientific American's Prize Competition for the best simple explanation of the Fourth Dimension The prize of $500 was awarded to Lieut-Col Graham Denby Fitch, U S A His essay was published in the Scientific American for July 4th, 1909 and three others which were accorded honorable mention by the judges followed in successive issues

It seemed to the judges that of the 245 essays submitted, a certain number showed more than passing merit Inasmuch as the popular literature on the subject is by no means extensive, the publishers decided to intrust to Prof Henry P Manning of Brown University, one of the judges the task of selecting some of the best contributions This Prof Manning has done These essays together with the essays which were awarded the prize and honorable mention, are now published in a book which has just been issued by Munn & Co publishers of the Scientific American An elaborate introduction is provided by Prof Manning, in which he critically and yet simply discusses fourth-dimensional geometry and gives an excellent bibliography on the subject The book sells for $1 50 and can be ordered through any newsdealer or bookseller

The deepest coal seams mined in America lie above a depth of 2 300 feet some of the coal mines in England are developing seams at a depth of 3 600 feet while coal mining is carried on at a depth of about 4,000 feet in Belgium.



The Seine near the mint.

The inundation of Paris made many of the streets of that metropolis as navigable as the canals of Venice. The highest point reached by the water was 31 feet 4 inches above the normal at the Pont Royal. Not since the historic flood of 1615 has Paris been visited by such an inundation. On January 29th the waters began to fall, and the city for the first time began to feel safe. Even as it was, the Seine was swollen to thirty times its ordinary volume and the current raced to the sea twenty times faster than usual. The banks have been overflowed for from half a mile to a mile on either side. That vast and wonderful sewer system which figures so dramatically in Victor Hugo's "Les Misérables" and which has been dwelt upon time and time again in every guide book of Paris, and that intricate system of subways which handles the vast traffic of Paris, have both played their part in this catastrophe. They served as conduits for the flood. Huge as they are, they were unable to cope with the turbulent waters. Pavements were pressed upward, and the water bubbled up into the streets. Apprehension was felt for the safety of the monuments of the French capital, an apprehension which is not yet stilled. It seemed almost certain that their foundations would be sapped. It speaks well for the work of French engineers that none of the twenty-four bridges that span the Seine was carried away, and that it was found necessary to close but eight of them. On the other hand, these bridges undoubtedly helped to dam the waters and to aid in the city's inundation. It speaks well for the architects and masons of the middle ages that the famous Cathedral of Notre Dame should have stood in a lake for days and days without suffering injury. Many of the historic buildings of Paris were flooded, but fortunately the art treasures seem all to have been preserved with little or no injury. When the saturated ground dries out and contracts, it may be that some of the buildings will settle and possibly collapse. The Louvre, although flooded, was still able to serve its function of housing its priceless paintings and its statues. The great shops could not be opened on account of the water. The famous Théâtre Français still gave its performances, but it used candles as it did back in the days of Molière.

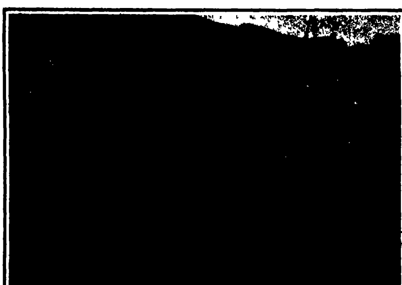
It was but natural that the Chamber of Deputies should have continued its sessions. An exhibition of fright on the part of the legislators would undoubtedly have heightened the public terror. As it was, the members were ferried across the square to the chamber. The old Latin Quarter and the Champ de Mars, the Rue Royale, the Boulevard Haussmann, the Place de la Concorde, the Champs Elysées were swamped.

Naturally the subways suffered heavily. Only the Gare du Nord seems to have escaped. The station of St. Lazare seems to have suffered most severely. As it was, the suburban traffic was entirely cut off, so that the sparing of the Gare du Nord served simply to give the frightened populace a place of questionable refuge. Fortunately the waters rose so gradually that the inhabitants of the sewers (the theme of many a thrilling French short story) and of the basements and sub-cellars of Paris were able to escape. Suburban towns lying somewhat lower than the city have suffered. The breaking of a dyke completely inundated Gennevilliers. Its community of 10,000 persons was driven out by ten feet of water.

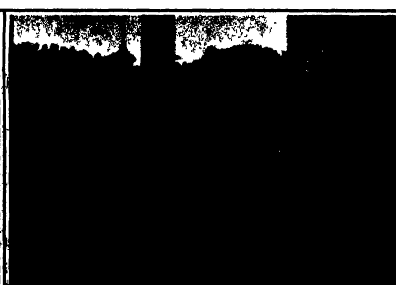
Paris may now be considered safe from water, but the danger from sickness still prevails. The stench of the stagnant water and of the drowned animals will undoubtedly continue for days. The Paris health authorities will find difficulty in coping with that situation.

The actual cause of the flood has not been fully revealed. Some explain it geologically by arguing that the basin of the Seine had become saturated during a mild winter, characterized by heavy rains and little evaporation. It will be safer before accepting this theory to await the investigation of the municipal engineers. Only when the floods have subsided and a careful examination can be made, will the full measure of the disaster be ascertained. The accounts of bursting sewers and subways and caving streets point indubitably to the necessity of reconstructing much of the famed Parisian sewer and subway systems. It will probably be months before Paris will conduct business as it did before the flood.

The engineering aspects of the flood have been sufficiently discussed in our editorial of February 5th. For that reason the results of this Parisian inundation need not here be dwelt upon again. It is clear that either the channel of the Seine must be widened by dredging, by the removal of river piers, or by the inordinately expensive construction of an artificial waterway around the city, a waterway which will serve the purpose of diverting the surplus of the Seine in time of flood and of discharging it below the city.



The gondoliers of Paris.



A cart-ferry in one of the streets.

SCENES OF THE GREAT FLOOD.

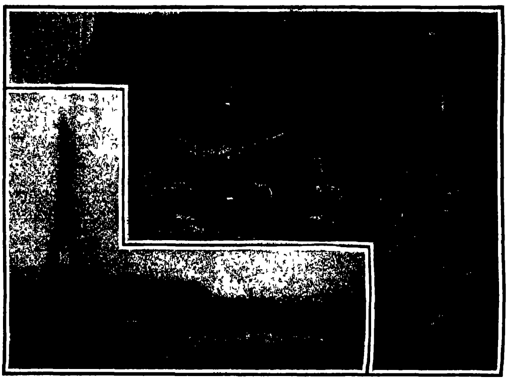
Reclamation of the Friedeburg Peat Bogs.

The total area of the peat bogs and moors of Germany is more than 3,000 square miles, of which about two-fifths are situated in Hanover and Schleswig-Holstein. The Prussian government possesses in East Friesland nearly 40,000 acres of upland moors, of which about 16,000 acres, known as the Aurich, or Friedeburg bogs, have for some years been the scene of an attempt at reclamation, which is being carried on with great skill and energy, though unfortunately with a degree of secrecy which makes it difficult to ascertain the exact facts, although the undertaking is of the greatest and most general importance It is contemplated not only to reclaim the moors for cultivation and settlement, but also to make them the source of energy which will supply electric current for light and power to the surrounding region within a radius of thirty miles. Electric light, thus obtained, is already supplied to Emden, Wilhelmshaven, and several other cities and towns, and large quantities of ammonia, hydrogen sulphide, and other gaseous products are sold for use in various industries. The district to be reclaimed lies between the Ems-Jahde canal on the north and the Nordgeorgsfehn canal on the south, between which a connecting canal will be constructed. Short canals will connect the system with the canals of the older moor colonies to the westward. In all, 38 miles of new canals will be required Their construction will necessitate the stripping of about 650 acres of moor, from which it is estimated that nearly 250 million cubic feet of peat will be obtained If this work were done by the old Dutch method, the canals would not be finished in several decades, during which period the price of peat, already very low in this district, would continue to decline Both of these difficulties were avoided simultaneously by the adoption of electrical methods, by which the work of excavation is carried on very rapidly and supplies its own fuel In the center of the moor is a boiler plant, which consumes peat exclusively The problem of course, will be still more simplified when a method of producing electricity directly from heat is developed

The first settlers established on the Friedeburg moor will carry on what is known as surface cultivation, and will at the same time gather peat, which they will sell to the electrical company, the charter of which runs for seventy five years. As the high moor is thus cut down the method of cultivation will be gradually changed to that which is employed in the low-lying moors of Holland

All of the energy is supplied from the central power station of the Siemens-Schuckert Company, situated on an island in the bog at the intersection of two main roads. From this point wires, supported by poles, radiate in all directions, supplying light and power to the whole country for many miles around The main canal is bordered by several rows of poles and wires, one for the telephone, another for the peat-digging and agricultural machinery, a third for the high-tension alternating-current long-distance service Current was to be supplied to the surrounding cities in November of this year The station is equipped with two steam turbines of 1,800 horse power each The great plows used for the excavation of the canals have long been driven by electricity The peat dug each day is compressed by electric presses into 4,000 blocks, which when dry are used as fuel in the central station In the gas generators 40,000 cubic feet of fuel gas and 30 pounds of ammonium sulphate are obtained from 100 pounds of peat. The combustion of this quantity of fuel gas generates 273 horse power hours of energy, while the sale of the ammonia compounds pays a good interest on the capital invested Contracts for supplying light and power to most of the surrounding towns and cities have already been signed. The duration of the contract in most cases is forty years, while the charter of the Siemens Schuckert Company will remain in force seventy five years The area assigned for cultivation and settlement comprises about 17 000 acres The digging of the canal requires the peat to be removed from a strip about 150 feet wide, so that the construction of the 38 miles of canal will involve the stripping of 650 acres The average depth of the peat is 11½ feet Deducting the superficial stratum of 30 inches, which is comparatively worthless, the digging of all the canals will produce about 247 million cubic feet of peat, which when dried will furnish 1 1/3 million tons of fuel peat. This amount of fuel alone would supply the central station, producing five million kilowatt hours of energy for sixty-six years On each side of each canal, a strip 165 feet wide is to be cleared of peat for cultivation and settlement The peat thus obtained, added to that obtained from the canals, would enable the capacity of the station for the duration of its charter to be tripled

An idea of the cost of the electric light and power thus furnished may be gained from the contract recently concluded with the town of Baut, in which the price of lighting current is fixed at about 10 cents and that of power current at 5 cents, per kilowatt hour At these rates a 16-candle carbon incandescent lamp or a 40-candle metal filament lamp would cost about ½ cent per hour and an arc lamp from 2 to 6½ cents per hour according to its candle power Thus the Friedeburg bogs are to be utilized as a field for colonization, as a source of light for the surrounding country within a radius of 30 miles, and as a cheap and reliable source of power for all the cities and farms of East Friesland. Although all the hopes which have been built on the enterprise may not be fulfilled, it is already certain that the reclamation and cultivation of bog land has entered upon a new and promising stage of development in consequence of this application of electricity It must be admitted however, that on the Friedeburg moor the conditions for reclamation are especially favorable The land is in general level, and it has already been superficially dried and smoothed by burning The roads through the moor are already bordered with rankly-growing grass



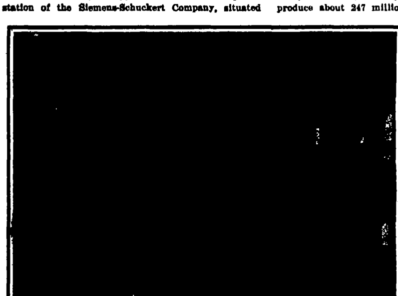
Scenes from the great Paris flood.

Peary a Rear Admiral.

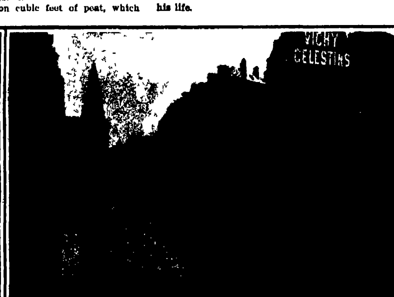
Commander Robert E Peary has been made a rear admiral of the highest grade and with maximum pay, so far as the Senate can accomplish such recognition of his services The bill recently introduced by Senator Hale was favorably reported from the Committee on Naval Affairs and promptly passed without discussion

The bill authorizes the President to appoint Commander Peary a rear admiral with an extra number and places him on the retired list. An amendment was adopted giving him the pay of a rear admiral of the first grade

The top notch pay of a rear admiral is $8,000 a year and that of the same officer on the retired list three-fourths of his active compensation Thus Admiral Peary will receive $6,000 a year for the remainder of his life.



The Gare du Quai d'Orsay flooded.



The submerged Rue de Lyon.

THE GREAT PARIS FLOOD.

Industrial Chimneys and Water Towers of Concrete Blocks

BY H. PRIME KIEFFER

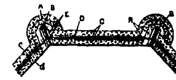
The employment of concrete blocks for the construction of factory or industrial chimneys and water towers is one of the most natural uses of that new form of building material. It is very surprising that the idea of utilizing separately molded blocks for this purpose should have come from Europe instead of America, where blocks have found a wider range of use than in any country in the world. The system is the ideal one for the rapid erection of factory chimneys. In the United States there have been in use some twenty different systems in which armored concrete is employed, but they all have some primary form of scaffolding in their designs. This is the underlying reason why those chimneys cannot be constructed more economically and rapidly. The method of constructing chimneys of separately molded concrete blocks is the invention of M. Dumas, an engineer and architect of Brussels, Belgium. It is controlled by Leon Monnoyer et Fils, also of Brussels, who furnished the data and photographs for the present article. The system is notable for its simplicity, its beauty of form, its economy in cost, and its adaptability to rapid construction.

The chimneys are like all others in that they are composed of three parts, the foundation, the base, and the shaft. The shaft is formed of reinforced concrete of a special design. The form of the blocks is shown in the accompanying diagram. The number of blocks in each course always remains the same, yet there is a taper to the chimney. They are placed in regular horizontal courses to the required height, and upon the top is placed a special capping block of either concrete, cast iron, or cut stone.

The builders work on a rough platform and from the interior of the structure, and each block is received by them ready for its particular position. Two men are usually employed above in laying the blocks, and two below to hoist them to the platform. The blocks in each succeeding course are placed in the opposite direction, that is to say, all the even courses will have the same direction and all the odd courses will take the reverse of this. In this manner, the joining of the blocks of one course where they do not meet perfectly will be covered by the blocks in the course above. As shown in the diagram, each block has at one of its extremities a "hook" similar to the shape of the letter "U." This "hook" forms a hollow space which extends the full length of the chimney, and of course there will be just as many of these hollow spaces as there are sides to the chimney. Through these vertical hollow spaces are placed vertical iron rods B, varying in diameter according to the height of the structure. At each course these rods are tied or bound to the courses by U-shaped flat iron yokes E. These in turn, are wired to a small iron rod D, which is placed between the courses horizontally and in a groove made for it in the top of the blocks.

The placing of the vertical rods in the openings and not in the substance of the shaft proper forms an important advantage of this system. The reinforcement is thus kept at a low temperature, and is not subject to the injurious effects which would arise from unequal expansion if the steel was in the center of the mass. Ferro-concrete is indestructible by fire so long as the temperature of decomposition of concrete is not reached, but it must be remembered that although the coefficients of expansion of cement are the same, the coefficients of conductibility are very different, and fracture is likely to arise if, from this cause, the temperature of the iron exceeds that of the concrete. Consideration of this condition is especially important in the case of a structure which is heated on one side only, such as a chimney.

A clever idea in connection with the design of the blocks is that there is need for only three, or at the most, four sizes of blocks for the average chimney of



A. Indicates the hidden reinforcing rods of the blocks.
B. The vertical steel reinforcing rod.
C. The concrete of the block.
D. The reinforcing rod connecting all the blocks in any one course.
E. A flat U-shaped iron brace which holds the vertical rod at a fixed position in the hollow space.
R. Mortar filling.

Cross-section of a portion of a concrete water tower. Section at one end of the joining of two of the courses.

Concrete-block chimney carrying two reservoirs of reinforced concrete.

Concrete-block water tower for the 1910 International Exposition at Brussels, Belgium.

INDUSTRIAL CHIMNEYS AND WATER TOWERS OF CONCRETE BLOCKS.

150 feet high and with a taper of one to three per cent. This is made possible by the following arrangement. The molds by which the blocks are made consist of but three cast-iron plates, held together by wooden stop blocks, and three ordinary iron clamps. Different sizes of blocks can be made therefore, by simply changing the relative positions of the plates and the wooden stop blocks. After the blocks are molded, they are placed in the following manner. Take, for instance, the first row, at the base. Here, naturally the blocks are of the largest size, and the arm of the block the longest. The arms of the blocks in this course are placed just to the edge of the hooks of the blocks and in the next course the arms are placed just a little farther into the hooks, and thus each succeeding course has a diameter smaller than the one below it, and in this manner, the taper of the chimney is obtained. As the longest blocks are some three feet in length and the distance across the semi-circular opening about six to eight inches, it is possible to make a considerable taper in this manner. For a taper of 1½ to 2 per cent, the size of the blocks is changed every forty or fifty feet. The blocks may, of course, be laid with absolutely no taper, and then one size, only, of blocks is used. Some chimneys have been constructed on this plan, but their appearance is not so graceful as those having a slight taper.

The concrete blocks are usually made at the chimney site, although they can of course be molded at a concrete block factory, and this may be economical in case there are several chimneys under construction in the same district. The proportions for the concrete mixture vary somewhat, but the usual mixture consists of about five parts gravel, three of sand, and two of cement. Dust of stone is used sometimes, and has given very good results. From an architectural point of view, the chimneys constructed with this system present a pleasing appearance. Being thinner than brick chimneys, they rise more gracefully from their bases, and yet the strength and stability which they actually possess is at once suggested to the eye by the appearance of strength which is presented by the protruding rounded angles.

A number of chimneys and water towers have been built in Europe after this system, and the two photographs presented in connection with this article show a water tower, and a combined water tower and chimney. The water tower which is located in Uccle, a suburb of Brussels, Belgium, will be used in connection with the 1910 exposition to be held in that city. The tower and tank have a height of 145 feet and the latter has a capacity of 280,000 gallons. The structure is circular and is built entirely of concrete blocks and without molding of any kind excepting that used in the building of the concrete reinforcing struts surrounding the base of the tank proper. The inside of the tank is built up in practically six stories connected by a winding stairway. These different floors are divided into rooms which will all be occupied by engineers, foremen and other workmen during the exposition. The stairways are placed along the outer walls and the water remains in the center inclosed by a concrete covering of square cross section.

Oil That Cold Will Not Affect.

It is often difficult to keep machinery properly oiled in cold weather, as the oil freezes in the oil holes and the cups, and the oil upon the ways of the lathe and planer becomes stiff, causing the machines to work hard. A good oil for winter use is made by mixing graphite with cylinder oil until in a thick or pasty consistency, and then adding kerosene until it flows freely. This oil will not become stiff at 14 degrees below zero, and is valuable to those operating machinery outside or in cold shops.—Power.

In his presidential address to the American Street and Interurban Railway Association, Mr. Shaw, at Denver, said that in round numbers there are 1,350 street and interurban railway companies in America, with a total of 35,000 miles of single-track and 75,000 passenger cars. The passengers carried annually is 10,000,000,000, and the gross income $44,000,000.

The Home Laboratory

THE CONSTRUCTION OF AN IMPROVED SILICON DETECTOR.

BY GEORGE F. WORTS

The detector described here is one that can easily take the name 'improved,' being a radical departure from the coarsely-adjusted detectors generally used. If properly constructed and connected, it will easily pick up wireless messages sent from very distant points. The component parts are shown in Fig 1.

The base of the instrument is fashioned from hard rubber, 3 x 2 x ⅛ inches, ⅛ inch holes are bored in it one inch from either end. A support for the crystal cup is made from annealed brass, 4 inches in length, ⅝ inch in width, and 3/16 inch in thickness. It is bent to an L shape, as can be seen in Fig 2.

The crystal cup is turned from brass rod ½ inch in diameter. It is threaded, as seen in Figs 1 and 2, to fit a thumb nut. The crystal is fastened in the cup by means of lead. This insures a good contact. The ad-

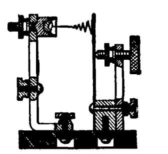


Fig. 1

SECTIONAL VIEW OF THE ASSEMBLED DETECTOR.

justing mechanism can be made to move a steel hair spiral, the point of which makes contact on the silicon to the thousandth part of an inch. The phosphor bronze strip upon which the spiral contact is fastened is 3 inches in length, ½ inch in width, of No 28 B & S gage sheet. It is bolted to a cube of brass which in turn is fastened by means of a machine screw to the base. This screw serves also as a binding post. The brass post supporting the adjusting screw is of 3/16 inch brass of the same stock as the L-shaped post. It is 2¼ inches in length, ⅝ inch in width, and 3/16 inch in thickness. A ⅛-inch hole is bored ½ inch from

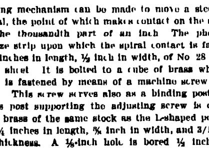


Fig 2. Fig 3

SUPPORTS FOR THE CRYSTAL AND THE ADJUSTING DEVICE.

one end to admit the machine screw that binds it to the brass cube. Another hole is bored ¼ inch from the other end and tapped to fit the adjusting screw. The adjusting screw has a large knurled rubber handle for adjusting purposes, also a lock nut to be tightened when the detector is at its most sensitive point.

This detector is comparatively easy to construct and is inexpensive. The one undesirable quality in silicon detectors—their ability to get out of adjustment—is almost entirely eliminated in this detector, due to the use of the spiral instead of the solid contact.

INCREASING THE EFFICIENCY OF WIMSHURST ELECTRIC MACHINES.

BY GEORGE J. MURDOCK

The Wimshurst static electric machine, as is well known, consists of two glass circles revolving on a compound axis in opposite directions. As usually made, this machine is inferior to the Toepler-Holtz type, although somewhat cheaper to make, and superior in simplicity. The latter quality has been without doubt one of the chief reasons why it is in general use wherever the small electric discharge this machine will give as commonly made, will answer the purpose.

In building both kinds of these interesting machines it is the practice to varnish the revolving glass circles with white shellac dissolved in alcohol. In the higher grade machines the best quality of shellac and grain alcohol are used for this varnish but for the toy variety wood alcohol and the cheapest grades of shellac are used. Some years ago the writer was building both Wimshurst and Toepler-Holtz statics, but was unable to obtain a discharge from the Wimshurst type that could compare with the other kind, even when the glass circles were of the same diameter.

The development of the machines in both cases had extended over a series of years, and it was supposed the limit was reached. At this time the Toepler-Holtz machines were giving with 26-inch circles sparks (using the Leyden jars) equal to the radius of the circles or 13 inches long, thick as the thumb and when discharging detonating like the sound of a rifle.

The Wimshurst machines with an equally large circle would not give sparks over 4 inches long, and about as thick as a knitting needle. Finally, in building a lot of six machines it was found some were much better than others. Strenuous efforts were made to ascertain what caused the increase in efficiency but without discovering anything different in the construction of those that showed the improvement from the others. In the next lot after this, however, all of the machines were capable of giving sparks 6 inches long, although the diameter of the glass circles was but 14 inches. The thickness of the spark had also increased to the size of a pipe stem and this wonderful increase of efficiency was attributed to some quality inherent in the glass of which the circles were made but inquiries made of the manufacturers of the glass failed to disclose any different methods of making the glass than had been followed for many years.

About this time the writer in varnishing some circles held one of them up to the light and was struck by its light green appearance and although giving it little attention at the time gained the impression that this change in color might have something to do with the increased efficiency still unaccounted for. Shortly after this a new lot of machines were built and every one of them had reverted to first principles so far as the spark was concerned it being short, weak, and spindling. In the effort to find out what had caused the reversion the writer called to mind that just before varnishing the last lot a new brush had been used in a new batch of varnish.

It is customary in making the varnish to dissolve the shellac gum in a glass jar with a mouth just large enough to get the brush in conveniently and the brush is left in the jar between the construction of the different lots of machines. It was found that the old brush had been shedding its bristles, and to prevent this it had been bound around with some fine copper wire. The action of the varnish had been to corrode the copper and the salt had given the varnish the faint green color noticed some time before on the glass circles, although there had been nothing different in the color of the body of varnish in the jar apparent.

The suspicion dawned on the mind of the writer that this had been the cause of the increase of efficiency and the lack of it in the last lot of machines. Another batch of varnish was accordingly made, and in it was put about a quarter of a pound of fine bare copper wire. A new brush was procured and placed in the jar and the varnish allowed to stand in a warm dark room about a week, when it had assumed a light green color, and was used to coat the circles of a new machine.

This machine was found on trial to be even more efficient than the best of the others.

In experimenting with the newly discovered varnish it was found that if it was allowed to become a dark green the voltage of the machine was interfered with and while the spark would be thicker it would not jump as far. The best results were obtained when the color was a very light green. The reason for the increased efficiency was thought to be due to a decrease of the resistance of the shellac between the sectors on which the equalizing brushes bear.

This varnish was tried on Toepler-Holtz machines without their showing any marked increase perhaps due to their being already capable of delivering sparks equal to the radius of the glass circles.

The use of varnish made in this way will be found by amateurs and others to add greatly to the capabilities of the Wimshurst machine, and besides the light green color on the glass adds to the beauty of the instrument.

Many builders of Wimshurst machines as well as those experimentally inclined have trouble in making the brass sectors stick to the shellac. As tinfoil soon wears through from contact with the equaliser brushes, thin sheet brass is used by many on the better grades of machines to secure durability. Brass sectors can be made to stick permanently in the following manner.

In varnishing the circles about three coats is generally applied with a large flat camel's hair brush. Each coat is allowed to become moderately hard before applying the next. After the last coat is applied, and has stood about fifteen minutes mark the locations where the sectors are to go (they should be evenly spaced), and after applying some varnish to the under side of the sector, press it down into the soft varnish until a slight ring swells up around the margin of the sector. After the varnish is hard an examination will show the sector dovetailed into the varnish from which it will never separate as it will if cemented in any other way on account of the expansion and contractions of the brass being so much greater than the glass, and causing the sector to become loose.

SILVERING GLASS AT HOME.

BY A. J. JARMAN

A good glass mirror made with one's own hands is a thing to be proud of. Mirrors are now seldom made by the tinfoil and mercury process because of the dangerous character of the work but pure silver is used instead. The silver process is not in the least dangerous to the workman. The formula here given is one that has been in use in several looking glass and art mirror factories in the city of London. The

Fig 1.

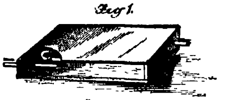
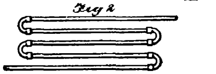


Fig 2.



APPARATUS REQUIRED FOR SILVERING GLASS.

chemicals used must be of absolute purity (chemically pure) and all operations in preparing the glass must be carried out with care and scrupulous cleanliness. The surface to be silvered must not be pressed upon by the fingers or thumbs they would leave an indelible impression.

The first thing to be done is to make a small table out of a piece of slate about ⅜ or ½ inch thick, 10 or 12 inches wide and 18 inches long. These measurements are not binding, any piece of slate about the above size will do. A wooden trough must be made with grooves at the top edges for the slate slab to rest in. There must be a space of 2 inches between the slate slab to the wooden bottom as indicated in Fig 1. In this space is a coil of pipe arranged as shown in Fig 2. The pipe is of about ⅜ inch bore and through it steam is passed to raise the temperature of the slate slab to about 120 deg. F. in fact just hot enough for the hand to bear. The steam can be supplied from an ordinary tea kettle placed near the depositing table with a rubber tube connecting the coil to the spout of the kettle. Uniform heating of the slate slab is essential. The coil can be easily made of ¼ inch iron gas piping screwed into U-shaped cast iron connectors, as shown in Fig 2. The slate slab can be covered with black oilcloth and made perfectly level. The following stock solutions must be made up and carefully filtered through absorbent cotton ready for use.

Stock Solution A—Nitrate of silver 3 ounces, distilled water 10 ounces, strong water ammonia 1¾ ounces. This solution must be stirred well and allowed to stand five or six hours, then add 10 ounces more of distilled water and filter.

Stock Solution B—Rochelle salts 4 ounces, distilled water 20 ounces.

Stock Solution C—Distilled water 40 ounces, protochloride of tin 5 grains.

Clean the glass plate or plates with very fine rouge and water taking care that no trace of grease whatsoever comes into contact with the glass or the cloths or chamois leather used for polishing. When cleaned the plate must be flooded all over with the tin solution. Pour this solution off and wash the plate well with distilled water. Lay the plate wet side up upon the table with four clean wood wedges at each corner. Let the glass rest on the wedges so as to allow a slight adjustment if required for levelling. The mixture for silvering is made up as follows.

Distilled water 20 ounces, stock solution B 1 drachm by measure, stock solution A 1 ounce by measure. The glass plate being quite level and still wet pour this mixture carefully and slowly upon the center. It will flow evenly all over until it stands about one-eighth of an inch deep all over the plate. Any tendency to run to one end must be rectified by the wedges. The plate now being completely covered with the silvering mixture must be left to itself for about two hours, the heat being kept up during this time, and when it is found that the whole of the silver has been deposited the liquid must be poured off by tilting and allowed to run into a stoneware crock and saved

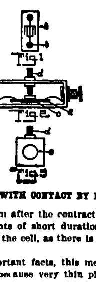
for the waste silver it contains. If it is desired to increase the thickness of the deposit of silver, the operation must be repeated as soon as the silvering is complete, wash the plate well in a soft stream of running water, stand it cornerwise to drain and dry When dry the following protective varnish must be used as a coating to protect the deposited silver Shellac, ½ pound, wood alcohol, 6 pints As soon as this coating has dried it must be painted over again with the following paint Red lead ½ pound, white lead, ½ pound, mixed with enough boiled oil and a small quantity of turpentine to make a good covering with a single coating A small quantity of gold size must also be added to insure quick drying and a tough adhering quality The mirror is now ready for framing If much work has to be done, it will be advisable to cover the slate all over with a piece of felt, and keep the felt wet during the operation for two reasons First no pieces of woollen fiber can settle upon the plate, and secondly, the heat from the slate slab is communicated to the glass better than from a dry surface

For a regular workshop a very good size is 4 by 7 feet with a gutter cut around the slab, so that the spent silvering liquid can run from the tilted plate, around the table and be collected by running through a hole at one corner In this case the liquid will be sure to come in contact with the felt This will prove of no consequence because in time it will become saturated with silver, which will realize twenty times its first cost when sent to the silver refiner, and not only pay for a new felt covering, but increase the size of the pocket book at the same time The quantity of nitrate of silver required to coat a square foot of glass with a moderate coating of silver is 18 grains An estimate as to cost can be made from this amount

SELENIUM CELL WITH CONTACT BY PRESSURE

BY W S GRIPENBERG

The usual method of making a selenium cell consists in pressing the electrodes against a piece of crystallized selenium, which decreases its resistance to an electric current, when submitted to the action of light The quality of selenium can be perfectly controlled, as it needs not come in contact with metal when fluid in which state it dissolves nearly all metals (i e, the electrodes) This is of importance, because small quantities of other elements sometimes have considerable influence on its sensitiveness Moreover a piece of selenium, that for some reason has lost its efficiency, can be easily replaced by another piece, at low cost The most important point, however, is that the contraction or decrease in volume (5 to 8 per cent), which is inseparable from the process of crystallization, has no influence whatever upon the contact with the electrodes, as the piece of selenium is



SELENIUM CELL WITH CONTACT BY PRESSURE.

given its definite form after the contraction has taken place Strong currents of short duration do not lead to the destruction of the cell, as there is full scope for expansion

Despite these important facts, this method has not been hitherto used because very thin plates of selenium are necessary as the action of light is limited to an extremely thin layer of the exposed surface (calculated by Marc to be about 1/500,000 inch thick) Moreover, selenium is rather fragile and being of high resistance heavy pressure must be used in order to realize good contact

The author discovered that selenium, when molten between a cold and a very hot glass plate, strongly adheres to the latter, after the crystallisation. It is thus possible to cover a thin (1/250 inch) flexible glass plate with an exceedingly thin coating of selenium (1/1 000 to 1/30 000 inch) which has a highly polished surface that gives very good contact with the electrodes These consist of gilt stripes on a glass plate (Fig 1) There are from 250 to 2,500 electrodes on every inch

Cells constructed after this method are very reliable and show remarkable constancy They are of small specific working surface The following is a description of a cell actually made

Working surface = ¼ by ¼ inch

Resistance in the dark = 20,000 ohms.

Resistance in ordinary daylight = 10,000 ohms.

Resistance in strong light = 3,000 ohms.

Maximum intensity of current = 0 0018 ampere.

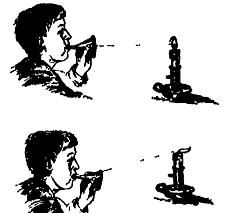
Fig 2 gives a diagram of the cell.

Fig. 3 is an end view of same

Glass plates with a thin coating of metal (silver) have before now been used as electrodes for substances sensitive to light This combination or at least the results attained are new

SOME SCIENTIFIC AMUSEMENTS.

The Candle and the Funnel.—Ask a person to extinguish a lighted candle, two feet distant from his mouth, by blowing through a common tin funnel with his lips applied to the stem Almost invariably, he will fail to accomplish the feat, although he could easily have blown out the candle without using the funnel Now put your own mouth to the stem of the funnel and blow out the candle If you have any skill in performing tricks you can repeat this one many times without betraying its secret to the average spectator The secret is this When you blow into the small end of a funnel, your breath follows the inner surface of the cone, and not only shuns the axis, but produces eddies of such a character that there is actually a slight back draft or inward current at the center of the wide mouth of the funnel You, therefore, hold the



RIGHT AND WRONG WAY OF BLOWING OUT A CANDLE.

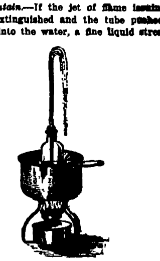
funnel so that some part of its conical surface would, if extended, strike the candle flame An inexperienced person naturally directs the axis of the funnel toward the candle and consequently fails to extinguish the flame If he stands quite near the candle and blows gently the flame will even be drawn toward the funnel by the inward current. The whirling motion of the air may be made visible by using a glass funnel and filling it with tobacco smoke

Paradoxes of Ebullition.—Everybody knows that water boils at the temperature of 212 deg Fahr But if an uncorked bottle partly filled with water is set in a saucepan containing water in which a good deal of salt has been dissolved, and the pan is heated over a spirit lamp or otherwise, the water in the bottle will begin to boil while the water outside still remains perfectly quiet Yet the water outside must be at least as hot as the water inside (212 deg Fahr), for the latter is heated by the former Hence we see that water which contains salt in solution does not boil at 212 deg. Fahr The same effect is produced by dissolving any other solid substance in the water

Now, if the bottle is taken from the hot brine and corked, the water in the bottle stops boiling, but it will boil again, even after it has cooled many degrees, if cold water is poured on the upper part of the bottle. The explanation is that the boiling point of water is affected by pressure. It is about 212 deg. Fahr under the ordinary pressure of the atmosphere (exactly 212 deg when the barometer stands at 30 inches) but if the pressure is reduced, water boils at a lower temperature When the water bottle was corked and taken from the fire, its upper part was filled with steam at atmospheric pressure, which had expelled the air originally present. As the bottle cooled, this steam partly condensed and its pressure was diminished, but not sufficiently to permit the water to boil, because the water cooled also and its gradually diminishing temperature was always a little below the boiling point corresponding to the actual pressure But the application of the cold water caused a rapid condensation of steam and a sudden lowering of the pressure without having much cooling effect on the water, which consequently began to boil.

Distillation.—The same apparatus may be employed to illustrate the process of distillation The brine in the pan is replaced by fresh water, a hole is bored in the cork and a glass tube is fitted to the hole To the water in the bottle is added one-tenth its volume of alcohol, or less. The bottle and pan are placed over the lamp, as before, and heated gently Before the water in the pan has reached the boiling point the vapor of the more volatile alcohol (mixed with a little water vapor) issues from the end of the glass tube, where its presence can be detected by its odor or by the application of a lighted match, which will result in the production of a tall blue flame. The jet should not be lighted until the mixture has been heated long enough to expel the air from the bottle, as the ignition of a mixture of air and alcohol would produce a violent explosion. For this reason the cork, though it should be air-tight, should not be inserted too tightly With this precaution an explosion will drive out the cork, instead of shattering the bottle. This experiment, and the others performed with this apparatus, should not be attempted by children or careless persons.

Hero's Fountain.—If the jet of flame issuing from the tube is extinguished and the tube pushed down until it dips into the water, a fine liquid stream will

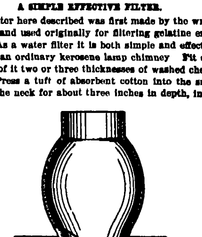


MODIFIED FORM OF HERO'S FOUNTAIN.

be thrown high in the air by the pressure of the mixed vapors of alcohol and water in the upper part of the bottle.—Kosmos.

A SIMPLE EFFECTIVE FILTER.

The filter here described was first made by the writer in 1878, and used originally for filtering gelatine emulsions. As a water filter it is both simple and effective Procure an ordinary kerosene lamp chimney Fit over the end of it two or three thicknesses of washed cheese cloth Press a tuft of absorbent cotton into the small part of the neck for about three inches in depth, insert



HOME-MADE FILTER.

the chimney, and place it in a hole cut in a wooden shelf as a support. Pour the water in until the filter is filled, when it will be observed that any organic matter, chips of iron rust, etc., will be retained by the cotton The fine organic matter may penetrate the cotton for about one inch, but no farther The resultant filtered water will be bright, clean, and pure

A paper dealing with "Research on Metallic Filament Lamps," by Mr F H Reakes Lavender, was recently presented at a meeting of the Birmingham Institution of Electrical Engineers. The research was undertaken in order to investigate the conditions of working as regards voltage, and efficiency and percentage drop in candle-power, giving the most economical life in the case of metallic filament glow lamps, and to determine as far as possible the cost of illumination with this source of light. The author stated that the useful life of a lamp, and the drop in candle-power which it was advisable to allow for a given voltage, depended on the cost of current and the price of the lamp The cheaper the current, the longer the life, and the greater the admissible drop. Taking the current at 5d. per unit as an average price, and the lamp run at rated voltage, then it paid in the case of the tantalum class of lamp to throw it away as soon as the candle-power had fallen to 3 per cent below its original value. This result appeared startling at first, considering the large initial cost of the lamp However, by the time that point was reached the lamp had been burning for 1,500 hours at the best possible efficiency, so that the cost of the lamp per candle-power had become small.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

ARTIFICIAL AIGRET AND LIKE ARTICLE.—M. Veit, New York, N Y The aim in this case is to provide an artificial ornament, such as an aigret, plume, feather, hat and dress trimming, military ornament, hair ornament and the like, and formed from a sheet of celluloid or other material, and arranged to provide graceful filaments projecting integrally from a self-sustaining core.

BODY BRACE.—R. F MacClemmy, New York, N Y This invention relates more particularly to a shoulder brace, in which there are two back sections, each having an arm hole therein, lacing or cords connecting the sections together, and belt sections connected to the ends of the cords and buckling together in front to adjust the back sections in respect to each other Mr MacClemmy has invented another body-brace, and one of its main features resides in the construction of the upper ends of the stays, so that one of the stays is secured across its top and the other is left partially free, so that it may overlap the first-named stay, and the intermediate portion will be folded to a definite and predetermined position

Of Interest to Farmers.

CONCAVE FOR THRESHING MACHINES.—W L. Hay, Franklin, Tenn This improvement is for use for threshers of all kinds. It provides a concave having adjustable sections so that one of the sections may be shifted to disengage the teeth without disturbing the relative position of the teeth immediately adjacent Simple means are provided for effecting the adjustment.

HARROW.—A M Hauck, Seattle, Wash This invention relates to harrows provided with wheels for cutting or pulverizing the soil or clods The invention provides means whereby the shafts upon which the wheels are mounted may be moved toward and from one another, in order to vary the degree of fineness with which the earth is pulverized.

Of General Interest.

BATTLESHIP ARMOR.—E. P Watson, Sr., Bentonville, Ark The armor is such as carried by battleships, protected cruisers, and other warships. Merchant ships can be constructed near the water line in accordance with the present improvement, but the shell resisting parts of the armor may be omitted during peace, but applied to the ships so as to transform them into armored ships of war

PROCESS OF WIRING BOTTLES.—O Tosz, Blaagaardsgade 16a, Copenhagen, Denmark. The invention is especially adapted to prevent the twisted sharp edges of wire from sticking out and thereby constituting a common source of danger from cuts and wounds to those who later on have to handle the bottles. The process can be carried out by hand or with a pair of pliers.

LIQUID-COOLER.—E Russell, New York, N Y An object of the inventor is to provide a cooler in which ice or other refrigerating substance is contained in a vacuum and is surrounded by vacuum chambers to minimize the melting of the refrigerating substance, owing to the transmission chamber, and which has means for conducting the fluid to be cooled through the refrigerating chamber

SCREEN FOR IRRIGATING DITCHES.—T A Powers, Black Wyo This invention is an improvement in screens for ditches, especially for irrigating ditches to be placed at or near head gates. In operation the screen will stand normally when the gate is in position for use at an angle of about forty five degrees, hinged at its lower end and adapted at its upper end to be depressed down stream by the action of pressure from above and to permit the debris to pass after which the screen may be readjusted to position for use

DISPLAY RACK.—J A. Bogar, Lykens, Pa. This invention relates more particularly to such racks as are provided with frames, on which rugs, wallpaper or the like can be suitably arranged for display purposes, and which are further provided with means whereby any number of objects on display can be temporarily removed from the frames to disclose a desired one originally concealed by the same on account of their super-position

FOLDABLE TABLE AND ATTACHMENT THEREFOR.—H F Thomas, Natrona, Pa. This invention refers to an improvement in foldable legs for tables and in a pedal attachment for such legs. It is particularly designed for use with tables, or like supports, for portable foldable dark rooms used for photographic purposes, but it is not restricted to such use.

Hardware and Tools.

COMBINATION PADLOCK.—L. Rosen, Union Hill, N J In this case a locking mechanism is controlled by a combination mechanism. The device is intended to be strong in construction, inexpensive and of a type that cannot be readily picked. Simple means provide for a series of combinations that may be changed almost indefinitely

LOCK.—J Jensenc, Pocatello, Idaho. In the arrangement of this combination padlock the combination may be easily changed, and should any one attempt to discover the combination by bringing the recesses into register, with the bar withdrawn, such attempt would be thwarted, since the combination would not answer after the disk was returned to its first position.

Machines and Mechanical Devices.

AUTOMATIC ADJUSTABLE REEL.—C H. Cook, Saugerties, N Y The aim of the inventor is to produce a reel in which the virtual diameter remains sufficiently constant In other words, the diameter of the reel reduces itself automatically as the web of the material wraps upon it In this way the length of material wrapped upon the reel in one revolution remains constant, and when the material on the full reel is cut, the sheets will all have the same length

COUNTERBALANCE FOR WATER PUMPS.—W Koerus, Jr Brinkman Ridge Wis. The purpose of this invention is to provide a construction for a counterbalance that is an attachment for a water pump which will balance the weight of the pump rod and the bucket on it, and of water lifted by the rod and bucket on it and of water lifted by the rod and bucket, thus reducing labor in operating a pump having the improvement

STEAM RENDERING TANK AND PRESS.—C H Stadler, New York N Y The objects here are, first, to provide a tank for cooking materials out of which grease oils etc, are rendered under steam pressure second to draw off the grease oils etc after the materials have been cooked third to drain the water and remaining grease from the materials left in the tank fourth, to press the materials for the removal of any still remaining oil grease, water, etc

Prime Movers and Their Accessories.

ROTARY ENGINE.—W G Sheppard, Indianola, Neb The device consists generally speaking of a rotor having a vane fixed thereon, a fulcrum valve means for letting a motive fluid in between said fulcrum valve and said vane on either side thereof, and means for exhausting the motive fluid from between the fulcrum valve and the vane

INTERNAL COMBUSTION ENGINE.—F Reagor Oak Cliff Texas. The invention resides in a peculiar arrangement of a plurality of cylinders in conjunction with a single main or engine shaft with which shaft one or all of the cylinders may be connected independently and at will, thus enabling the main shaft to be driven from the operation of a single cylinder while the other cylinder or cylinders, with all of their immediately allied parts, remain absolutely inactive

Railways and Their Accessories.

RAILROAD-TIE.—J S Miller, Clinton, Neb Mr Miller's invention has for its purpose the provision of a concrete tie on which the rails may be supported the tie being so constructed that it is reinforced by the means provided for securing the rails Also the provision of means in connection with the reinforcing members for spacing the ties apart at a predetermined distance from each other

Pertaining to Recreation.

BOWLING-CABINET.—R H Mulford, Connellsville, Pa This cabinet is especially adapted to be used as part of the furniture of a bowling alley The object is to produce a cabinet which will constitute a bench upon which the players or spectators may seat themselves, and which has a special construction enabling the cabinet to hold the bowling pins, the bowling balls, and also the hats and coats of the players.

PYROTECHNICAL BUTTON.—A. Jeder, New York N Y A special object of this invention is to provide a trick or joke device, which may be secured on the person, and which when ignited, produces a startling or unexpected effect Means provide for safely and securely holding the compound, so that it may be worn and ignited, while on the person without liability of personal injury

GAME APPARATUS.—C F Doerr, Yonkers, N Y The invention pertains to parlor games, and its aim is to provide an improved game apparatus, more especially designed for playing baseball, and arranged to afford amusement to the players and onlookers and to require considerable skill on the part of players to successfully play the game

MUTOSCOPE.—A S. Ferguson, Springfield Mo. The invention is adapted for use as a toy or parlor amusement, the same consisting essentially of a series of photos or other pictures arranged radially in a circle, thus forming what may be termed a picture wheel which being rotated, the pictures are successively turned back and thus exhibited to the onlooker

Pertaining to Vehicles.

GASOLENE FEED.—A W Horacker Bottineau, N D The object here is to provide a means for insuring a constant supply of liquid fluid to the carbureter of a power driven vehicle regardless of the inclination of the body of the same as when hill climbing In vehicles having the engine in front, and the fuel tank beneath the seat, the carbureter will not get a sufficient supply of fuel when the front of the vehicle is elevated, as in hill climbing, especially if the fuel supply is low

Note.—Copies of any of these patents will be furnished by Munn & Co for ten cents each Please state the name of the patentee, title of the invention, and date of this paper

NEW BOOKS, ETC.

Manual of Physical Geography. By Frederick Valentine Emerson, Ph.D New York The Macmillan Company, 1909 8vo, 291 pp Price, $1 40

The exercises in this manual have for the most part emanated from the author's classroom experiences There is presented a variety of exercises, some of them advanced in character that will cover topics capable of laboratory illustration usually presented in a course in physical geography Some of the questions are practical For instance, let us take up the subject of fog Here are a few of the questions What is fog? What is its general cause? Where have you seen it occur? If over land or water, what is the apparent cause? How dense is it? Does it disappear suddenly or slowly? Did you see the fog around a piece of ice or a water pitcher on a hot day? What effect has fog on bodily sensations? What on economics? The fogs of London The book is especially valuable to advanced students

Practical Engineer Pocket Book for 1910 London The Technical Publishing Company, Ltd 16mo, 684 pp. Cloth, price 1s net, leather, gilt, with diary or ruled section paper, 1s. 6d net, postage 3d extra. Price, 60 cents.

We have reviewed various editions of this book for a number of years and have found that the information conveyed was reliable and is presented in such form as to be very readily available The excellent indexes are to be particularly commended

Ether of Space. By Sir Oliver Lodge, F R S 16mo, 168 pp

Sir Oliver Lodge needs no introduction to the readers of this paper He is well known as an exponent of the ultra modern physical theory with which the English school of physicists have been identified In this book he explains in a simple way the necessary conception of an ether and formulates theories which, although some of them have not yet gained current acceptance will undoubtedly do so in time

The Water Supply, Sewerage, and Plumbing of Modern City Buildings By William Paul Gerhard, C.E. New York John Wiley & Sons. London Chapman & Hall, Ltd, 1910 8vo, 493 pp Price, $4

The present work is an extremely valuable one The engineering problems connected with the modern city building are very complicated The chapters, while correlated to each other, are purposely so written that each one is complete in itself and each one may be read or studied without reference to the others The book is splendidly illustrated by means of helpful diagrams and half tones. The titles of the chapters are as follows Essential Features of the Hydraulic and Sanitary Engineering of Buildings Sanitary Fixtures and Appliances. Advanced and Simplified Plumbing Plumbing in its Relation to Disease and Municipal Control of Plumbing Domestic Water Supply The Water Supply of Large Modern City Buildings. The Maintenance of Pipe Systems for Sewage, Gas and Water Rules on Plumbing Water Supply and Sewerage chiefly for Hospital Buildings and other Public Institutions. Mr Gerhard has an international reputation as a sanitary engineer and this book may be looked upon as authoritative

Automobile Driving Self-Taught By Thomas H Russell, M E, LL.B Chicago The Charles C Thompson Company, 1908 12mo, 222 pp Price, $1.

As comfort and safety in automobiling depend to a very large extent upon the skill of the driver it should be the aim of every one who intends to drive a car to acquire a knowledge of the approved methods of driving It is the object of this book to present such information in a convenient practical manner so as to make it comparatively easy for any motorist to acquire skill in the management and care of his machine Study and practice combined will surely develop the expertness which is needed nowadays at the wheel being demanded alike by the interests of the automobilist and of the non motoring public The careless or ignorant driver is a menace not only to the safety of the public, but also to that of his passengers The daily experience of every motorist demonstrates the need of carefulness in driving and there is no longer any excuse for ignorance The methods of driving are described in this work and those which have been found best in actual experience on the road. From these pages the motorist can learn how to start, drive and manage his car under all conceivable circumstances Those methods of caring for the car when not in use are also plainly shown as well as the manner in which a car should be laid up when necessary The book appears to be a most practical one

Concrete. By John C Trautwine, Jr and John C Trautwine, Third, Civil Engineers. New York John Wiley & Sons, 1909 16mo Price, $2 net

Trautwine's Civil Engineer's Pocketbook is too well known to need any praise at our hands The nineteenth edition of 1909 completed the hundredth thousandth copy which is a phenomenal sale for a scientific and technical book. In fact, we believe this is the largest sale on record for any such book The most notable of the new features in this new edition is a series of articles on concrete plain reinforced, natural cement, sand and water Practically all this matter, occupying about 200 pages, is entirely new as far as its publication is concerned. For the convenience of many engineers the section on concrete has been reprinted in the form of a handy volume which should be in the hands of all engineers Typographically, the book is perfect for an engineer's pocketbook The high professional standing of the engineers who have compiled the book is sufficient guarantee of its accuracy

Radford's Combined House and Barn Plan Book Edited by William A Radford New York and Chicago The Radford Architectural Company, 1908 4to, 287 pp Price, $1

The volume before us is a most practical one, giving designs for barns, livery stables, grain barns dairies, cow barns feed lofts cattle sheds, poultry houses implement sheds vehicle sheds, hog houses, corn cribs smoke houses, granaries, tank houses, etc The illustrations serve the purpose, although they are rather coarse Prices for blue prints, which would enable any one to build these barns, are listed

Practical Engineer Electrical Pocket Book and Diary for 1910 London Technical Publishing Company, Ltd 16mo, 570 pp Price, cloth, 1s net, leather, gilt, 1s 6d net, postage 2d extra.

This welcome annual visitor contains as usual valuable statistics, data, rules, tables, formulae etc, and should be in the hands of all who are interested in electrical matters

Problems in Wood Turning By Fred D Crawshaw, B S, M E. Peoria, Ill The Manual Arts Press, 1909 12mo Price, 80 cents.

Wood turning is considerable of an art, requiring quite a little knack of handling the tools. The present work is an extremely practical one, and the illustrations are the best we have ever seen in a book on wood turning The various projects are admirably worked out

Handbuch für Heer und Flotte. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete, herausgegeben von Georg von Alten, Generalleutnant z D, unter Mitwirkung von mehr als 200 der bedeutendsten Fach autoritäten Complete in 108 instalments. Price per instalment, 50 cents Berlin, Leipzig, Vienna and Stuttgart Deutsches Verlagshaus Bong & Co.

The first three instalments of the second volume of this remarkable military and naval encyclopedia lie before us. The instalments extend from 'Bayreuth" to 'Beurkundung' In the care which has been taken in the individual articles these new instalments are well up to the standard of those which we have previously reviewed Of particular interest are the articles on benzine and benzol The essay on Belgium may well be regarded as a model of good military writing for it discusses clearly and masterfully the military geography history and military system of a small but important European body politic

Power, Heating and Ventilation A Treatise for Designing and Constructing Engineers, Architects and Students By Charles L. Hubbard, B S, M E. Part II, Power and Lighting First edition Brattleboro, Vt The Technical Press, 1909 8vo pp 397 Price, $2

The author has produced a thoroughly practical book which will be warmly welcomed by all engineers who have charge of power and lighting plants There is always room for a good book on this subject and the author has certainly produced a most admirable treatise which is worthy of a large sale

Power Heating and Ventilation A Treatise for Designing and Constructing Engineers Architects and Students. By Charles L Hubbard, B S, M E Part III Heating and Ventilation First edition Brattleboro, Vt. The Technical Press, 1909 8vo, pp 647 Price, $2

This is a very practical book dealing with all phases of warming and ventilation Even such subjects as electrical heating are taken up The illustrations are excellent the expensive but eminently successful wax process being used The tables are also of great value The subject is treated with rare discrimination and the book cannot help but be of great use to all engineers

Romantic Germany By Robert Haven Schauffler New York The Century Company, 1909 397 pp Price, $3 50 net

The beautiful book with a charming cover so suggestive of old Germany is a delightful one The plates are charming and they are beautifully reproduced in various tints and colors The cities which are discussed are Danzig Berlin Potsdam Brunswick Goslar Hildesheim Leipzig Meissen Dresden Munich, Augsburg and Rothenburg—certainly a galaxy of names to conjure with It has been a long time since a good book has been produced on Germany which

deals with the land itself and not with its politics history sociology, commerce and science Indeed the would-be visitor has to look back to "Views Afoot" written by young Bayard Taylor in the year 1846 To those who have left the beaten track Germany still remains the land of the Nibelungenlied and of Grimm's Fairy Tales of gnomes and giants storks and turreted ring-walls of Gothic houses in rows and the glamor of medieval courtyards Many of these towns have preserved almost intact their old-world might and a touch of real romance is to be found as well as in almost every one of the larger cities not of which we have been taught to consider ... It is hoped that the present volume will lure the traveler from his hard beaten track in France Switzerland and Italy to the fresh regions of Romantic Germany

SIMPLIFIED MECHANICAL PERSPECTIVE By Frank Forrest Frederick Peoria Ill The Manual Arts Press 1908-1909 8vo., 54 pp Price 75 cents

This is a treatise for the use of high schools technical and manual training high school evening and industrial schools and all schools The author has used the methods outlined for more than twenty years and he states that he has never had a student learn much about the subject unless he carefully worked each problem and thoroughly understood it before attempting the next The problems are admirable and a thorough mastering of this work will give any one an excellent idea of perspective

THE DESIGN AND EQUIPMENT OF SMALL CHEMICAL LABORATORIES By Richard K Meade B S Chicago The Chemical Engineer Publishing Company 1908 12mo., 136 pp Price, $2

It very often happens that the young chemist perhaps fresh from college is called upon to design and equip a laboratory when his knowledge of how it is to be done is rather meager The experienced chemist confronted with the task can usually bring to bear upon the subject sufficient practical knowledge gained from other laboratories in which he has worked to arrange and equip a laboratory which will meet fully his requirements and can do so in many instances better than any body else can do it for him Many things which are done in the college laboratory are impossible in the private laboratory where means are limited for instance ventilation of the hoods, gas supply may be non-existent etc To these young chemists the suggestions in this book on the design and equipment of small laboratories are made But even experienced chemists may gain valuable points from it There is an extremely small amount of literature on this subject so that a thoroughly practical book like this should be warmly welcomed

NUTRITION AND DIETETICS By Winfield S Hall, Ph D, M D New York and London D Appleton & Co, 1910 8vo, 315 pp

This is a valuable manual for students of medicine for trained nurses and for dietetists in hospitals and other institutions During more than ten years the author has been presenting the subject of nutrition to classes of undergraduates in medicine and to the nurses of two of the large city hospitals There has been a repeated request for a concise text book suitable not only for undergraduates and nurses but also for the general practitioner and covering the whole field of dietetics but no such book seemed available The one thing which is notable in this volume is the absence of receipts These are hardly necessary as the doctor does not require them and the nurses already have them in other forms The book is a very excellent one, including a classification of diets The book is printed in a good size type and is well bound

MODERN LETTERING ARTISTIC AND PRACTICAL By William Heyny New York William T Comstock, 1909 8vo, 136 pp Price $2

This is a book of instruction primarily valuable in the hands of the beginner and of assistance to the experienced workman Modern Lettering essays the subject from the practical standpoint from cover to cover The author a man of experience and of artistic temperament boldly sets forth his ideas and propounds his methods in concise language Directions even to minute details are given all of which are valuable to the student The plates are all on a large scale and the letters are clear and sharp The French Roman is a new letter in this country and will be appreciated for its refinement beauty and legibility Much valuable information the fruit of the author's long experience is given on the choice of alphabets the arrangement of words and the spacing of letters with good criticism of faults of modern letterers

IN A YORKSHIRE GARDEN By Reginald Farrer London Edward Arnold, 1909 8vo 316 pp

The author is very much in love with his subject He has already written "My Rock Garden" "Alpine and Bog Plants" as well as other works The present volume deals with "The Dreadful Dawn"

NATURAL SALVATION (SALVATION BY SCIENCE) By Charles Asbury Stephens, M D Norway Lake Me The Laboratory, 1910 8vo 157 pp

Noteworthy Articles

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending February 8, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

OTHER WORLDS IN SPACE.

(Continued from page 160)

graph is being taken. A careful observer with such an accurate instrument will obtain the spectrum of the star in the middle of the photograph flanked on either side by the spectrum of the metal iron or titanium or the gas hydrogen, placed there by the use of the electric current and induction coil Astronomers use different metals for the purpose of comparison, the Yerkes Observatory, for instance, employs both iron and titanium on the same plate

A good photographic spectrum will then consist of that of the star to be investigated, supplemented by the lines of the comparison spectrum How are these spectrograms to be interpreted? And how can they tell us anything about stellar motions? Remembering that light is a wave motion, we have a simple analogy in the case of sound, and one with which everyone is familiar In traveling in an express train which passes another going in the opposite direction, we have all of us noticed that the pitch or tone of the whistle or bell of the other engine suddenly drops as it passes by us. The reason is that sound is also a wave motion (though the waves are much different from those which cause light) and the quickly approaching engine causes more waves to crowd into our ears each second of time than it does when the engines are not moving As the tone is determined by the number of waves which fall on the ear drum every second, the consequence is that the pitch of the whistle or bell is raised while the two trains are approaching, and for the same reason it is lowered when the two after passing are going away from each other The change in the tone of the whistle depends on the speed of the two trains and also on the velocity of sound and as these are comparable, a decided change in tone is readily noticed

Applying the same ideas to light we have what is known in science as the Doppler principle of motion in the line of sight A vast number of waves of light impinge on the retina of the eye in every second and excite in the rods and cores the sensation which our brain interprets as light If the light is red, then four hundred millions of millions of waves (4×10^{14}) enter the eye every second, if the light produced is violet, about twice that number In spite of the fact that these vast numbers of waves come into the eye so quickly, if the source of light toward which we are looking is moving toward us, then as a result more waves are crowded into the eye in each second and if the body is moving away from us fewer than the normal amount come into the eye Evidently the shift from the normal is excessively small, but even so, it is a measurable quantity for the astronomer with his methods of precision A shift toward the violet means that the waves are crowded together and the star is approaching the earth, a shift toward the rear end of the spectrum signifies that star and earth are separating from each other A measure of the shift gives the velocity of the star in miles per second

The calculation of these velocities in the line of sight is now a great, fruitful field of astronomical research and many important developments have been made in it It is a far cry from the small spectroscope that is ordinarily used in a physical laboratory to the magnificent Yerkes telescope and its refined spectrograph (SCIENTIFIC AMERICAN, December 25th, 1909) This required not only vast improvements in the instruments themselves but in methods all through as well The refinements of present day work are due more to Prof W W Campbell, director of the Lick Observatory, than to any other man He has been a leader in all plans of spectroscopic work, and his methods are largely followed wherever such researches are attempted.

To the uninitiated the photograph of a stellar spectrum shows remarkably little. Even with the great 40-inch Yerkes

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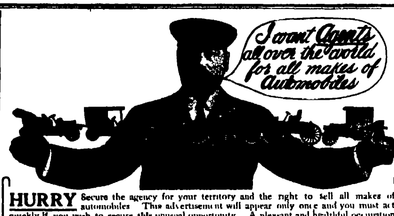

(*Continued from page 170.*)

lons a photographic plate 1 2/3 x 4 inches only is used and in the center of this are some faint streaks of light about two inches long and possibly one sixteenth of an inch in width This tells the whole story of the star's motion Naturally this photograph is placed under the microscope for examination and there it appears magnified and is measured The physical constitution of the star the metals that compose it is known from the lines of the stellar spectrum hydrogen for instance showing its badge by a series of prominent lines The motion of the star is shown by the placing of these lines, whether they are shifted from their normal position as given by the comparison spectrum to the violet or toward the red end of the spectrum If there is hydrogen in the star then the lines of the hydrogen comparison spectrum give the position of rest or zero velocity with respect to the earth, and the amount of the shift measured under the microscope gives the motion of the star If there are other lines in the spectrum of the star (as is usually the case) we can readily in an analogous fashion measure the motion The photographs in the illustration were taken at the Yerkes Observatory with the great 40-inch telescope Two separate spectra are there shown taken but three days apart on January 5th and 8th 1906 The star spectrum appears in each between the comparison spectrum of titanium and it is widened to make the lines more prominent and the whole greatly enlarged The violet end is toward the left, red end to the right Portions of the comparison spectra on both are cut away to bring the two closer The numbers on the top give the wave lengths Notice that all the lines in the lower spectrum are shifted much more to the right with respect to the comparison lines than in the upper spectrum This is specially noticeable at line 4501 and better still at 4481 A measure of the amount of these shifts gives the radial velocity of the star with respect to the earth The variable velocity in the line of sight of this star shows it is not a single star but a system Measures made by the writer on the star β Trianguli show the following results where the radial velocities are given in miles per second relative to the sun The plus sign means that the star is increasing its distance from the sun and a minus sign that it is moving toward the sun

Date		Velocity in line of sight
1908—Sept	7	+ 33 miles per second
Sept	8	+ 31 miles per second
Sept.	18	— 5 miles per second
Oct	5	+ 1 mile per second
Oct	12	+ 20 miles per second
Nov	8	+ 18 miles per second

The measures must be carried out with utmost care If the spectrum of the star is good with many well defined lines, the radial velocity (i e toward or away from us) may be determined to an accuracy of one-tenth of a mile per second Think of this when light travels at the rate of 186,000 miles per second when six hundred millions of millions of waves enter the spectroscope every second and when in addition the star is so far distant that its light even when traveling at such enormous velocities might take hundreds or thousands of years to reach us! To contemplate it makes our minds whirl at the enormity of space and causes us to bow down in reverence to the wonderful human intellect that can solve such problems!

Investigations of certain stars show us that at one time it may be moving toward our sun once in a few days or weeks the direction of motion may be reversed and it is traveling away from the sun The star of itself is unable to change its motion, and another body must be present so that variable velocities in the line of sight as in β Trianguli denote that two or more suns are present in a system and they are in revolution about each other At our distance from the stars the

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Paper or similar fabric in web form manipulating, Knapp & Pancoast	948 540
Paper weight and fan combined J Keith	948,611
Parer and corer, combined vegetable A Chase	948,878

(Concluded from page 171)

sideways displacement is not of sufficient magnitude to make the stars appear separately, and hence we have a comparatively new class of stars, those which appear as single even in the most powerful telescopes, but whose motions in the spectroscope show that they are really double suns. These are called spectroscopic binaries. Recent researches at the Lick Observatory, Yerkes Observatory and other places bring to our knowledge most startling results. Imagine two suns each many times more massive than our own, rapidly revolving about each other in a few hours! In addition to this comes the fact that at least one in every few stars so far investigated turns out to be not a single star but a system, and it has become necessary to reconstruct our ideas regarding the importance in the universe of this small ball which we call Mother Earth.

Dying Pearls.

(Concluded from page 169.)

chill which can very easily cause its tender outer layers to contract and its beautiful luster to disappear Unfortunately the Thiers collar has been laid on red velvet, and this circumstance, too, can help to dull its shimmering surfaces day by day, for the color also, produced by chemical means, exercises a slow but sure influence. Besides it lies too near a window, and so the rays of light, too, have an injurious effect on it The directors of the Museum of the Louvre have long deemed the collar one of their most precious curiosities, but now, in consequence of the evident steady diminution of its value, they would like to sell it and with the money obtained for it procure a few more good paintings. Permission therefor, however, is refused by the executrix and chief heiress of the Thiers estate, and consequently the jewelers of Paris consider the collar an object of experiment by which it will be shown in how many years a pearl can "die away" when nothing is done for its preservation. How long pearls "live," that is, how long they keep their luster, has not yet been ascertained, but, as many instances, especially in the successive inheritance of heirlooms, prove, some preserve their freshness through centuries in consequence of the habitual gentle treatment they receive When treated thoughtlessly a pearl dies quickly

Life Insurance and the Moral Responsibility of Employers.

BY DARWIN P KINGSLEY

The growth of life insurance and the development of a deep sense of responsibility on the part of employers of labor toward their employees are contemporaneous and kindred phenomena They represent a better knowledge of the value of human life and a recognition of the increasing demand now fairly made on the controlling forces of society, by age and industrial misfortune, as well as by infancy, congenital incapacity, and weakness

The middle-aged and the socially inefficient now form a relatively larger section of society than ever before There are two reasons for this The first is, that while there may not be as many children born now as formerly, among certain people, of the number born a much larger portion reach maturity In other words, the ratio of adults to a given number of births has increased. The second reason is that modern business methods and the modern corporation, especially the manufacturing corporation, have created new conditions and complications. They have added to those who join the dependent classes under a simpler life, those who become dependent because their active lives have been devoted to highly specialized work.

Highly specialized labor is constantly menaced by loss of occupation, and this menace increases as the age of the worker advances. Under the fierce competition

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Pipe, M Rheinauer	948,550
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Pipe coupling, train, R. M. Dixon	948,812
Pipe hanger, A A Noyes	948,902
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Pipe threading machine, R. A. Hoefer	948,894
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Plow attachment, C W Bechert	948 478
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Powder magazine Ervin & Keeton	948 923
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Sewing machine embroidering or darning foot, W C Ellis	948 693
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Stovepipe holder, L. A. & W. J. Shaw	948,[illegible]

(Continued from page 172)

which governs the greater portion of our industrial life, new processes, new methods, short cuts, labor-saving devices, new inventions, are all eagerly sought by the employer of labor Some of these are revolutionary in their effects They call for a readjustment of the whole plant When that readjustment comes, the older men are invariably dropped In short, the avenues which lead to employment, for all highly specialized labor, are practically open now only to youth The middle-aged man enters with difficulty and the man past middle life substantially cannot enter at all The man who did many things, none of them highly specialized from twenty to sixty five, is likely never to become entirely dependent upon society The man who did some highly specialized piece of work which involved only a part of some specific thing, or even a part of a part, may be forced into the dependent class before he reaches old age, and when he joins that class he is much more helpless than the man who has done many things It is probable that the specialist, altough he labored fewer years, rendered society the more valuable service of the two, and that therefore he has, morally at least, a clearer title to consideration But however that may be, he is the inevitable product of the whole plan of society and business, and the obligation of the man who employs him and the interest of general society in what finally becomes of him, are clear and unavoidable That this class must be shown how to protect itself against the menace which it constantly faces or that it must be helped outright after disaster or age come are compelling facts in the sociology of the times.

There can be no question that a system which teaches these people how to protect themselves against this menace, is more in harmony with the genius of our institutions than a system which coerces them into action or a system which finally places the burden of their support and care upon general society It does not follow that a system which works well in Germany would work well here, or that a system which appeals to the needs of the people of Great Britain will answer here. There are distinct advantages in the German plan,—chiefly that it is compulsory and that the laborer is forced to make provision for certain benefits even though he may have no very intelligent understanding of the wisdom of the plan or its effects on society There is a difference between the compulsion of government, which tells the workingman that certain things must be done, and the proposition of a corporation which tells a man what the conditions of his hiring are

If the conditions named by the employer involve some system of life insurance some system of deferred annuities, a man can study the question and take a position or leave it alone because it recommends itself to his judgment or otherwise This is a slower process than the German method and probably for a good many years will be more expensive, but it seems to me to be in harmony with our notions of individual responsibility and the rights as well as the obligations of American citizenship

The efficient employee, in specialized labor, has a fair claim to something beyond the returns contained in the ordinary contract of hiring This right may be strengthened and its realization advanced, but it cannot directly be met, in this country, by governmental action The capable worker deserves and should demand a programme of hiring under which he shall be entitled—and entitled by contract not by the grace of his employer—to certain protection for his family if he dies prematurely, and to certain protection for himself if in the vicissitudes of industrial war he is shelved and wholly or in part compelled to join the dependent class

There are sound reasons why corpor

(Concluded on page 174)

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Toy, educational, H. B. Palmer	948,621
Track brace, A. J. Coover	948,590
Train stopping and signal actuating mechanism, J. F. Webb, Jr.	948,361
Transferring apparatus, material, J. Callahan	948,710
Tree protector, F. J. McNamara	948,359
Trolley wires and the like, suspension device for, H. A. Mead	948,780
Trousers stretcher, H. B. Liddle	948,734
Trousers stretcher and presser, W. A. Lane	948,805
Truck, casket, J. Pfeifer	948,492
Truck, hand, J. Buckley	948,964
Trunk, Kallis & Berg	948,783
Truss, hernial, J. Bunker	948,3[illegible] to 948,307
Tube. See Mailing tube.	
Tubes, manufacture of, M. Peters	948,961
Tug, thill, W. J. Campbell	948,780
Turbine, G. A. Boddy	948,910
Turn table, H. B. Stickney	948,852
Twine cutter, H. I. Mattson	948,898
Type casting machine, W. N. Clements	948,605
Typewriter, H. I. Cary (now by marriage H. L. Bloodworth)	948,952
Typewriter escapement mechanism, F. H. Ross	948,553
Typewriting machine, R. N. McCormack	948,481
Typewriting machine, A. W. Steiger	948,486
Typewriting machine, McLaughlin & Reber	948,668
Typewriting machine, J. C. McLaughlin	948,669
Typewriting machine, A. M. Stone	948,780
Typewriting machine, E. B. Hess. 948,972	948,974
Typewriting machine supporting frame, C. D. Rice	948,826
Undercutter support, W. J. Whitworth	948,836
Unicycle, A. G. Jackulsk	948,830
Valve, G. B. Kennington	948,454
Valve, G. W. A. Koelkebeck	948,649
Valve and operating means therefor, ball cock, Neal & Childress	948,519
Valve attachment, flush, W. F. Geiger	948,878
Valve, clean out boiler check, J. R. Martin	948,702
Valve for blending hot and cold fluids, S. G. Neal	948,520
Valve, gate, A. Watson	948,770
Valve gear, J. Irving	948,970
Valve mechanism, air operated electrically controlled, J. F. Webb, Jr. 948,405	948,406
Valve mechanism for air brake and train stopping systems, air operated electrically controlled, J. F. Webb, Jr.	948,404
Valve mechanism, non return, C. E. Golden	948,445
Valve, pneumatic safety, F. Moyle	948,440
Valve, universal controlling, W. C. Arp et al	948,571
Vaporizing and mixing device, C. F. Creston	948,402
Vehicle brake, automatic, G. W. Fisher	948,418
Vehicle driving mechanism, J. F. Waite	948,749
Vehicle motor, R. Fuller	948,817
Vehicle motor, G. W. Terry, Jr.	948,741
Vehicle washer, E. Muller	948,537
Vehicle wheel, E. S. Williamson	948,621
Vehicles, elastic suspension for, L. Rasso	948,699
Vending apparatus, A. H. Arnold	948,914
Vending machine, J. H. Carroll	948,600
Vending machine, W. Asbury	948,838
Ventilating system, A. S. Johnson	948,629
Vessel closure, J. C. Schleicher	948,747
Voting mechanism, M. A. Dees	948,757
Wagon dump, W. A. Underhill	948,[illegible]
Wagon seat lock, A. W. Heydlauff	948,765
Washboard, Ullrich & Weigert	948,900
Washboard clamp, J. E. Terhune	948,907
Washboiler, S. C. Logan	948,807
Washer. See Vehicle washer.	
Washer, J. H. Vanney	948,600
Watch regulator, W. F. Porter	948,653
Water closet seat, auxiliary, J. G. Steffee	948,708
Water closet, etc., tank, G. H. Bailey. 948,657	948,658
Water gage guard, D. Ruisseau	948,41[illegible]
Water motor, I. I. Dodds	948,501
Water motor, current, H. R. Fenner	948,544
Water purifying apparatus, J. P. Lajoie	948,785
Water purifying apparatus, automatic circuit controller for, H. R. Hartman	948,649
Water supply, automatic device for controlling, J. A. Anderson	948,903
Water wheel, F. Bangerter	948,7[illegible]
Web manipulating mechanism, Knapp & Lancaster	948,548
Welding apparatus, F. G. Budd	948,965
Welding, brazing, or soldering, electric, O. Kjellberg	948,704
Well cover, R. D. Huntting	948,720
Well drilling machine, G. D. Loomis	948,425
Wheel, T. Bernison	948,408
Wheel, R. R. Sandham	948,674
Wheel drive, magnetic traction, C. Scott	948,381
Wheel rim, removable, J. C. Cole	948,819
Whiffletree hook, J. M. Tappan	948,351
Whiffletree hook, P. H. Skarlen	948,527
Whip socket, Goldstein & Voigt	948,319
Winding machine, yarn, H. S. Holland	948,320
Window, H. J. Davison	948,858
Window cleaner, J. R. Lane	948,631
Window cleaner, H. L. Bailey	948,641
Window pane fastener, W. G. Kueter	948,957
Window screen, I. I. Brighton	948,844
Window ventilation, J. J. Best	948,770
Window ventilator and storm shield, R. A. Dunlap	948,417
Wire, means for applying coverings to, J. A. Heany	948,324
Wood in salt water, protecting, Tairo & Bellus	948,356
Wrench, F. Knobel	948,932
Wrench, L. I. Barrick	948,870
Wrench, C. Wittman	948,948
Writing machine, F. B. Hess	948,971
Zinc from zinciferous materials, obtaining, H. Pape	948,740

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

Home-Made Experimental Apparatus

In addition to the following articles, the Scientific American Supplement has published innumerable papers of immense practical value, of which over 17,000 are listed in a carefully prepared catalogue, which will be sent free of charge to any address. Copies of the Scientific American Supplement cost 10 cents each.

If there is any scientific, mechanical or engineering subject on which special information is desired, some papers will be found in this catalogue in which it is fully discussed by competent authority.

A few of the many valuable articles on the making of experimental apparatus at home are given in the following list:

ELECTRIC LIGHTING FOR AMATEURS. The article tells how a small and simple experimental installation can be set up at home. Scientific American Supplement 1551.

AN ELECTRIC CHIME AND HOW IT MAY BE CONSTRUCTED AT HOME is described in Scientific American Supplement 1566.

THE CONSTRUCTION OF AN ELECTRIC THERMOSTAT is explained in Scientific American Supplement 1566.

HOW TO MAKE A 100-MILE WIRELESS TELEGRAPH OUTFIT is told by A. Frederick Collins in Scientific American Supplement 1605.

A SIMPLE TRANSFORMER FOR AMATEUR'S USE is so plainly described in Scientific American Supplement 1572 that anyone can make it.

A ¼ H. P. ALTERNATING CURRENT DYNAMO. Scientific American Supplement 1558.

THE CONSTRUCTION OF A SIMPLE PHOTOGRAPHIC AND MICRO-PHOTOGRAPHIC APPARATUS is simply explained in Scientific American Supplement 1574.

A SIMPLE CAMERA SHUTTER MADE OUT OF A PASTEBOARD BOX, PINS AND A RUBBER BAND is the subject of an article in Scientific American Supplement 1578.

HOW TO MAKE AN AEROPLANE OR GLIDING MACHINE is explained in Scientific American Supplement 1582, with working drawings.

EXPERIMENTS WITH A LAMP CHIMNEY. In this article it is shown how a lamp chimney may serve to indicate the pressure in the interior of a liquid, to explain the meaning of capillary elevation and depression, to serve as a hydraulic tourniquet, an aspirator and intermittent siphon, to demonstrate the ascent of liquids in exhaustive tubes, to illustrate the phenomena of the bursting bladder and of the expansive force of gases. Scientific American Supplement 1583.

HOW A TANGENT GALVANOMETER CAN BE USED FOR MAKING ELECTRICAL MEASUREMENTS is described in Scientific American Supplement 1584.

THE CONSTRUCTION OF AN INDEPENDENT INTERRUPTER. Clear diagrams giving actual dimensions are published. Scientific American Supplement 1615.

AN EASILY MADE HIGH FREQUENCY APPARATUS WHICH CAN BE USED TO OBTAIN EITHER D'ARSONVAL OR OUDIN CURRENTS is described in Scientific American Supplement 1618. A plunge battery of six cells, a two-inch spark induction coil, a pair of one-pint Leyden jars, and an inductance coil and all the apparatus required, most of which can be made at home.

SIMPLE WIRELESS TELEGRAPH SYSTEMS are described in Scientific American Supplements 1363 and 1381.

THE LOCATION AND ERECTION OF A 100-MILE WIRELESS TELEGRAPH STATION is clearly explained with the help of diagrams in Scientific American Supplement 1622.

THE INSTALLATION AND ADJUSTMENT OF A 100-MILE WIRELESS TELEGRAPH OUTFIT, illustrated with diagrams, Scientific American Supplement 1623.

THE MAKING AND THE USING OF A WIRELESS TELEGRAPH TUNING DEVICE, illustrated with diagrams, Scientific American Supplement 1624.

HOW TO MAKE A MAGIC LANTERN. Scientific American Supplement 1546.

THE CONSTRUCTION OF AN EDDY KITE. Scientific American Supplement 1555.

THE DEMAGNETIZATION OF A WATCH is thoroughly described in Scientific American Supplement 1561.

HOW A CALORIC OR HOT AIR ENGINE CAN BE MADE AT HOME is well explained with the help of illustrations in Scientific American Supplement 1573.

THE MAKING OF A RHEOSTAT is outlined in Scientific American Supplement 1594.

Good articles on SMALL WATER MOTORS are contained in Scientific American Supplement 1494, 1049, and 1406.

HOW AN ELECTRIC OVEN CAN BE MADE is explained in Scientific American Supplement 1472.

THE BUILDING OF A STORAGE BATTERY is described in Scientific American Supplement 1433.

A SEWING-MACHINE MOTOR OF SIMPLE DESIGN is described in Scientific American Supplement 1210.

A WHEATSTONE BRIDGE. Scientific American Supplement 1595.

Good articles on INDUCTION COILS are contained in Scientific American Supplements 1514, 1522, and 1527. Full details are given so that the coils can readily be made by anyone.

HOW TO MAKE A TELEPHONE is described in Scientific American Supplement 966.

A MODEL STEAM ENGINE is thoroughly described in Scientific American Supplement 1527.

HOW TO MAKE A THERMOSTAT is explained in Scientific American Supplements 1561, 1563 and 1566.

ANEROID BAROMETERS, Scientific American Supplements 1500 and 1554.

A WATER BATH. Scientific American Supplement 1464.

A CHEAP LATHE UPON WHICH MUCH VALUABLE WORK CAN BE DONE forms the subject of an article contained in Scientific American Supplement 1562.

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(Concluded from page 173.)

tions should avail themselves in this work of the highly developed system of insurance and annuities presented by the responsible insurance institutions of this and of other States. Any effective system if established by corporations independently, will be based on the principles and methods used by the insurance companies, and therefore the work for obvious reasons is in the end likely to be more effectively and more economically done by men who are experts and specialists than by men who undertake it with no special training and with minds chiefly occupied by the demands of other lines of work.

I shall therefore assume that life insurance, and probably other types of insurance including accident and sickness insurance, as represented by existing corporations is not only well equipped to help in the solution of this problem, but is a part of the evolution of the times which has produced the problem itself, and is another illustration of the curious fact that in the processes of evolution a solution of a problem often appears at the same time the problem itself is evolved. For example, what might have happened in the enormous industrial activity of the United States and its necessary output of securities seeking purchasers if millions of people combining their small savings in the reserves of the great life insurance companies had not appeared upon the scene contemporaneously seeking securities in which to invest their money? The function of life insurance and of other types of insurance on the one hand and the obligation of the employer of labor to his employees on the other, bear, it seem to me, an identical relation.

Life insurance is already effectively at work. While the employer of labor has only in the most limited way used the idea or appreciated its beneficence, progress has been made toward the solution of this problem. Eliminating industrial companies and including only those companies whose business is supposed to be confined to people of means, we find the average policy the country over is a little under $2,000. In other words the mass of so-called regular insurance is held by people of small means. If now we add to those the millions who carry what is called 'industrial' insurance, and the other millions who have so-called "fraternal" insurance we have covered substantially the whole insurance field. We comprehend an interest whose accumulations surpass those of any other single line of human endeavor except the accumulations of savings banks, and yet we have not gone outside of what may properly be called the laboring class. The energy of life insurance management, in other words, and the obligation which the laboring man feels toward his family have in their development far outrun the sense of obligation of the employer. We have now reached the point when the employer is beginning to do his part—but as yet he has only made a beginning. That he will do more is certain, that he will do much is almost equally certain. That existing insurance institutions will be utilized is, I believe, a necessity.

Alloys Formed by the Compression of Metal Powders.

The ordinary method of preparing alloys consists in melting two or more metals together, and allowing the melt to crystallize after cooling. Can not the same alloys be obtained by compressing the component metals at ordinary temperatures in the shape of fine powders? Dr. W. Spring showed as far back as 1882 that under a pressure of 5,000 atmospheres the powders of the constituents of the Rose and Wood alloys will form conglomerates, the melting points of which nearly coincide with those of the alloys obtained by melting. In 1888 Hallock showed that by merely mixing at ordinary pressures the powders of the same constituents there is obtained a mixture

(Concluded on page 175.)

(*Concluded from page 174.*)

melting at a lower temperature than the melting point of the most fusible component. By compressing zinc and copper powders, Spring obtained a conglomerate which was distinguished from brass only by its slightly darker color.

In spite of these partial results the problem had not so far been definitely solved. It remained in fact to be seen whether, by augmenting the speed of fusion of the mixed metal powders, pressure really favors the formation of those compounds which are characteristic of alloys obtained by melting. This question is answered by Prof G Tammann on the basis of recent experiments by G Masing.

When submitting a mixture of filings of two metals forming neither a chemical compound nor mixed crystals (e g, zinc and cadmium or copper and silver) to a pressure of 4 000 atmospheres, and heating the conglomerate thus obtained the rising curve of temperatures is seen at a given point to slacken down after reaching a temperature 10½ deg C higher than that at which the whole is found to melt. As far as its thermal properties and its structure are considered this conglomerate is practically identical with alloys obtained by melting.

Again by compressing under high pressure the powders of two metals forming a definite compound and capable of mixing in all proportions in a liquid condition and by heating the conglomerate thus obtained, two stopping points are found in the curve of temperatures. The first of these points corresponds with the melting of a compound formed at the surface while the other corresponds with the formation of the alloy. This is the case for instance, with mixtures of magnesium with zinc lead tin or bismuth. The conglomerate composed of magnesium and antimony has only a single stopping point situated at 300 deg C below the melting point of antimony. This corresponds with the formation of the compound Mg_3Sb_2.

The temperature then rises very rapidly in order to eventually fall down to the melting point of the alloy. The third case investigated by Masing relates to the conglomerate of two metals forming an uninterrupted series of mixed crystals, such as magnesium and cadmium on the one hand and lead and thallium on the other. When heating such conglomerates only a single stopping point is observed corresponding to the melting point of the most fusible component. The form then assumed by the curve depends on the diffusion of the two components into one another.

The conglomerates obtained merely by compression do not contain any trace of mixed crystals. Microscopical examination thus only shows the existence of grains of copper and tin in recently prepared conglomerates. If, however these mixtures be heated to 200 deg C (i e, below the melting point of the tin) there are found between the grains of copper and tin, two layers corresponding to the compounds Cu_3Sn and CuSn respectively. If these conglomerates be heated during 20 hours to 400 deg a layer of mixed crystals, corresponding to the formula Cu_4Sn, is found. This proves that compounds of these metals are permeable to their constituents.

The following conclusions are derived from these experiments.

The compression of two metals at ordinary temperatures will yield conglomerates containing only the pure metal i e neither compounds nor mixed crystals as characteristic of alloys obtained by melting. Mere compression thus does not activate diffusion sufficiently to bring about combination or the formation of mixed crystals. If, however, heated metals (i e., with increased speed of diffusion) are submitted to pressure there is obtained not only a more coherent mass, but a portion of the metals is found to form compounds and mixed crystals, so as to produce a conglomerate which is very much like a real alloy.

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A LOGGING RAILWAY THROUGH THE COCHIN JUNGLE SOUTH INDIA —[See page 184]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic* the contributions will receive special attention Accepted articles will be paid for at regular space rates

THE COMMISSIONER OF PATENTS' ANNUAL REPORT

THE annual report of the Commissioner of Patents Hon Edward B Moore, for the fiscal year ending June 30th, 1909, has recently been published and contains several useful suggestions for the improvement of the office of value to inventors and patentees

Referring to the work of the office, he says

There were received in the last fiscal year 62 800 applications for mechanical patents 1 186 applications for designs, 192 applications for reissues 2 052 caveats 7,509 applications for trade-marks, 1,001 applications for labels and 438 applications for prints There were 36 215 patents granted including reissues and designs and 4 547 trade marks, 779 labels, and 231 prints were registered The number of patents that expired was 22,779 The number of allowed applications which were by operation of law forfeited for nonpayment of the final fees, was 6,763

"The applications for patents for inventions have increased over last year by between 4,000 and 5,000 cases The applications for trade-marks, however show an increase of only 42 The number of trademarks registered shows a decrease of 1,598.

"The 'act to amend and consolidate the acts respecting copyrights,' which was approved March 4th, 1909, and which became effective July 1st, 1909, repealed the act approved June 18th, 1874, under section 3 of which labels and prints have been registered in the Patent Office Consequently no certificates of registration of labels or prints have been issued since July 1st, 1909, except those evidencing registrations effected on or before June 30th, 1909

"The money receipts from all sources were $1,975,-919 97, and the expenditures $1,887,443.35, leaving a net surplus of receipts over expenditures of $88,476 62 The grand total of receipts over expenditures for maintaining the bureau from 1836 to date is now $7,060,547. This vast sum represents the earnings of the Patent Office, and the bureau is therefore more than self-supporting"

Owing to his success in securing additional appropriations from Congress in 1908, the salaries of the examining corps were increased on July 1st of that year, resulting in a noted decrease in the annual resignations Owing to the additional force he was authorized to employ and the retention of the skilled examiners, the work in nearly all of the examining divisions of the office is practically current He aims to keep the work current in all branches of the office, if possible, which is certainly a most laudable purpose, and one that should be carefully considered by Congress He says

"The rapid increase in the number of applications filed and the constantly increasing field of search embracing as it does not only United States and foreign patents, but also publications of every character, make it imperative that additional force be provided each year to prevent accumulation of the work."

He has asked for one new principal examiner and twenty additional examiners to further the work of classification of patents. There are now 930,000 United States patents, approximately half of which have been reclassified Over 2,000,000 foreign patents and nearly 90,000 volumes of the scientific library remain to be classified

The models formerly stored in the basement and on the first floor of the Patent Office building have been moved to another fireproof warehouse a short distance away

Additional space for the storage of new volumes of foreign patents by at least 150 linear feet per annum should be provided for in the office library An appropriation of $2,000 for this purpose, which it is thought will be sufficient for a period of five years, is recommended

The space available for the storage of printed classified copies of patents is becoming crowded and the accommodations in the attorneys' and public search room are becoming insufficient for the work done there One of the long hallways that has been set apart for this purpose is in a congested condition and is inadequate for the purpose Some changes to afford temporary relief are suggested by remodeling the basement on three sides to conform to that of the Ninth Street front

He believes that the time has arrived when measures should be taken to secure the construction of a new larger building in which ample room will be afforded to properly and promptly transact the business of the office He says particularly

"It is necessary that patents for new inventions should be issued with the utmost promptness after the application for patent has been filed for such inventions form the basis of vast industries, which inure not merely to the profit of the inventor, but to the benefit of the manufacturer the laborer, the trader, the professional man, and the consumer, and to the commercial interests of the country in general Great Britain and Germany have each recognized the necessity of providing ample facilities for the work of their patent bureaus, and have each recently erected new buildings for their patent offices, which are in every way more commodious and better adapted for the business of a patent office than the building which now houses the United States Patent Office, although the patent business of each of those countries is small when compared with that transacted in the United States Patent Office

He urges that the new building be located near the Congressional Library on a square north of that building as embodied in Senate bill No 3,954, introduced by Senator Daniel, January 24th 1898 The surplus to the credit of the Patent Office in the Treasury Department of $7,060,547 he thinks would go far toward paying the expense of the building

As to future desired legislation he continues his recommendation in previous reports by advocating an amendment to the statute which has for its object the shortening the course of appeals from the primary examiner (in *ex parte* cases) to the board of examiners in chief and the Commissioner by combining the board of examiners in chief with the Commissioner of Patents and his first and second assistants into a single tribunal, any three of whom shall constitute a quorum, to which all appeals shall lie, whether from a primary examiner or from the examiner in interferences and from which appeals would lie to the Court of Appeals of the District of Columbia The elimination of one appeal, he states, would materially shorten the time required for the ultimate disposal of appealed cases and effect a considerable saving of expense to applicants We believe there is much merit in this recommendation and trust it may receive favorable consideration by Congress

A further additional provision recommended is the amending of section 4 889 of the patent law by requiring to be filed with the drawing two photographic copies thereof with the application One of the photographic copies is to be kept in the file wrapper and the other is to be filed in secret archives in charge of the chief draughtsman while the drawing itself will be kept constantly in the office of the examiner and will be available at all times for inspection in their respective divisions He states there have been cases of fraud in withdrawing and substituting other drawings for the originals and that some such plan is needed to detect possible unauthorized changes

We think it would be more practical for the Commissioner to have the negatives made of the drawing at the time the application is filed, and withhold the delivery of the filing receipt until the official photographer had certified the photograph as being an exact reproduction of the drawing

The Commissioner advocates the formation of a "patent bar," and suggests before an individual be permitted to practise before the Patent Office he will be required to pass an examination as to his moral, legal, and technical qualifications before a committee appointed by the Commissioner of Patents, composed of officials of the office and patent attorneys of well-known standing in the profession, who shall conduct the examination under the direction of the Commissioner The report of the committee is to be subject to his approval. This suggestion appears to us to be very appropriate

In regard to the amendment and improvement of treaties with other countries concerning industrial property, it is proper to say Commissioner Moore has been most successful in securing advantages for American inventors. He says on this subject

"I am gratified to report that during the last year a treaty was negotiated with Germany, which confers great benefits upon the American inventor The patent laws of nearly all the foreign countries contain a clause providing that if an invention is not "worked"—that is, manufactured or practised—in such country within a certain period, ranging from two to four years, the patent may be annulled. This treaty with Germany provides that the working of a patent in one of the contracting countries will have the same force and effect, so far as avoiding the revocation of the patent is concerned, as if it had been worked in the country in which the patent was granted This treaty has practically assured to American inventors the protection of their rights in Germany during the full period for which the German patent is issued, contingent only on the working of the invention in one of the two countries

"It is understood that Sweden has modified its laws to extend similar protection to other countries which do not require the working of the invention within a specified period, and negotiations are now pending with nearly all the European states for the promulgation of treaties of the same character In order to assist in the negotiations of these treaties, I have been delegated by the Department of State, and with your permission I shall visit the capitals of several foreign nations to assist, so far as within my power, in the negotiations of such treaties, which if concluded will greatly extend the protection of inventors, manufacturers, and the industrial interests of this country, as well as those of the nations with whom such arrangements may be made"

He states the next International Convention for the Protection of Industrial Property is to be held at Washington, D C, in May, 1911 About this he is most sanguine and enthusiastic He says

"The meeting of this convention is most important to the interests of the American inventors and manufacturers. The 21 nations which are adherents to this union will be represented by delegates having full power to negotiate agreements in respect to the reciprocal protection of patents, designs, trade-marks, and industrial models, which when ratified by their respective governments will have the force of treaties. The efforts of these conventions in the past have been crowned with success the agreements relating to the reciprocal protection of patents and trade-marks having been ratified by all adherents, which comprise the leading commercial nations of the world and the Congress of the United States has in each instance amended the patent laws of this country to accord with the terms of the international agreements concluded at these conventions

'Not only are the members of the union represented by delegates but all other civilized nations, not members of the union, are invited to send representatives in the interest of furthering the reciprocal protection of industrial property It is expected that at this coming convention a strong effort will be made to harmonize the laws relating to patents and trade-marks throughout all countries in such a manner that adequate protection will be given to an inventor, no matter of what country he may be a citizen, without the necessity of obtaining expensive patents in each of the several countries in which his invention may be used or sold It is also proposed to perfect and extend the international registration of trade-marks and thus further the reciprocal protection of commercial industries"

THE ALL-STEEL CAR THE CAR OF THE FUTURE

FOR many years past the SCIENTIFIC AMERICAN has strongly advocated, on grounds of public health and safety, the building of all-steel cars for railroad service, and we are therefore much gratified to learn that the Pennsylvania Railroad Company is adding to its steel-car equipment at a rate which promises, before many years, to eliminate the present wooden car, and provide that great system with an all-steel passenger car equipment It was on August 12th, 1906, that that railroad announced that all future passenger equipment would be built of steel and that the design would be such as to render it indestructible either by collision or fire. In planning the cars and establishing those standard types which are now being copied in all the new equipment, no expense has been spared to build a coach which should provide the greatest possible strength, and finish it with an inside lining that should be absolutely unburnable and possess the added and not inconsiderable advantage that it would be a poor conductor of heat and noise. The first order, placed in November 1906, was for 100 cars. Subsequent orders have been given, and there are now in service 245 coaches, 10 dining cars, 21 combination passenger and baggage cars, 29 baggage cars, 18 postal cars, and 1 company car, making a total of 324 steel cars. Furthermore, the Pullman Company has been building for the railroad during the past four years some all-steel parlor and sleeping cars. About 500 of these will shortly be placed in service With the present steel equipment and some 250 cars to be ordered during the present year, the Pennsylvania railroad will in a short while have in service 900 of its own steel passenger cars and about 500 steel Pullman cars.

ENGINEERING.

In a paper recently read by Mr Henry Hess before the American Society of Mechanical Engineers on the power lost in belting, it was shown that 90 per cent of the power transmission lost was due to journal friction. This may be materially reduced by substitution of ball for plain bearings, provided care be taken to suit the size of the balls to the load.

The Committee of the American Railway Maintenance-of-Way Association in a recent bulletin takes up the subject of rail specifications For Bessemer rails of 85 to 100 lbs. it recommends the following composition Carbon, 0 45 to 0 55, manganese, 0 85 to 1 15, phosphorus not to exceed 0 10, and sulphur not to exceed 0 075 The recommendations for open-hearth steel for the same weight of rail, carbon, 0 68 to 0 76, manganese, 0 75 to 1 00, phosphorus not to exceed 0 04, and sulphur not to exceed 0 06

The two latest German dreadnoughts are to be equipped with turbines, and special interest attaches to the fact that two rival types of turbine, the Parsons and the Curtis, will be tried out against each other The "Heimdal" will be propelled by triple screws operated by Curtis turbines, and the sister ship will be equipped with Parsons turbines of equal contract power

A method of simultaneously excavating and lining vertical shafts is contemplated in one of the contracts for the Catskill water supply In the shaft will be suspended a lining platform, from which the concrete forms will be erected and concrete laid The excavating will be carried on below, the material being hoisted through a hole in the center of the platform.

We recently noted in these columns the rapid increase in the weight of locomotives A similar growth is taking place in the cars, the Pennsylvania Railroad Co having recently asked for tenders for 10,000 coal cars of 70 tons capacity and an overload capacity of 10 per cent As the steel in the cars will weigh 20 tons exclusive of the wheels, the maximum weight of car and load may reach 100 tons

Apropos of marine turbines we note that Messrs Parsons & Co, recognizing the advantages of twin-screw propulsion, as proved in the Curtis equipment of the scout "Salem," have developed a modified Curtis partial admission turbine which they are to install in one of the new 5 200-ton 26-knot British scouts. A sister ship will have Curtis turbines The Parsons turbines will weigh 340 tons, and guarantee full power on 13 pounds of dry steam per horse-power per hour The Curtis turbine will weigh 250 tons and guarantee 12 5 pounds of superheated steam

There are persistent reports that the Hamburg American Line is about to build two huge steamers which will rival the White Star liners Olympic and Titanic, which are to be in service during 1911 The reported dimensions are Length, 850 feet, beam, 92 feet, and depth 66 feet Reciprocating engines of 48,000 horse-power will drive the ships at a speed of 21 knots

A recent bulletin of the United States Geological Survey gives some statistics of producer-gas power plants in the United States which are very favorable There are over 500 plants in operation, aggregating 115,000 horse-power The government testing plants at St. Louis and Norfolk show a fuel consumption of as low, under favorable conditions, as 0 95 pound per electrical horse-power Comparative tests of 75 grades of bituminous coal under steam boilers and in producers show a ratio of 2 7 in favor of the latter

One of the most important branches of the general scheme for the development of Japan is the extension of her railroad development along predetermined lines which have been laid out with an eye to the development of the country considered as a unit A notable event in this development was the recent completion of the railway between Hitoyoshi and Kagoshima, which connected up the last link in the trunk line running throughout the full length of the empire The total length of the line is 1,750 miles, and the distance from north to south of the island can now be covered in five days and nights. At the close of the fiscal year 1907-1908 4,453 miles of state railways were opened to traffic and 455 miles of railway controlled by private interests

A promising installation of a windmill-electric plant has recently been completed at Worcester, England, by J G. Childs & Co., of London It consists of a 24-foot wind turbine carried upon a 75-foot tower The generator is located at the foot of the tower, the battery and switchboard in one of the outbuildings of the house. Overhead copper cables carry the current to the battery some 455 yards distant. The generator which runs at 400 to 800 revolutions per minute is driven by a 5-inch belt from the vertical shaft of the wind turbine. It has a maximum output of 4 kilowatts with a normal pressure of 70 volts. The plant runs about 100 lights in the house, and serves also to drive a chaff cutter, a circular saw, and a root-pulping machine.

ELECTRICAL.

A company has been formed in London to introduce and encourage the use of electricity in the poorer districts of the city The company agrees to wire and supply any apartment of three rooms and over with tantalum lamps, charging five cents a week per lamp from April to September and seven cents a week for the rest of the year The lamps however must be renewed by the consumer

A new mounting for metallic filament in lamps has been devised in Germany The mounting provides for the shrinkage of the filament which is not always uniform, and for this reason each filament is supported at its lower end on a small spring which is covered with a paste of finely powdered tungsten so as to prevent it from being consumed by the heat of the incandescent filaments

The use of the telephone for train dispatching is slowly spreading The Gulf, Texas & Western Railroad is equipping its line with a telephone system for train dispatching between Jacksboro and Benjamin Texas. The road connects the Chicago, Rock Island & Gulf and the Wichita Valley railroads When the telephone system on the Spokane division of the Great Northern Railway is completed there will be 2 100 miles of this railroad operated by means of the telephone

A hydro-electric plant in the Hakone Mountains about 36 miles from Yokohama, Japan has recently been completed and is particularly interesting for the fact that much of the apparatus used is of Japanese make The Shibaura Electric Manufacturing Company of Tokio has built the 600-kilowatt air-cooled, oil immersed transformers to be used at the sub-station in Yokohama. A large number of the high tension insulators used on the line are of the Shibaura type About one-third of the line is supported on towers which is a new departure for Japan At the power station the water is carried over a distance of 15 000 feet in two parallel pipe lines that lead to the turbo-generator units The upper half of the pipe lines consists of riveted pipes made by the Shibaura Company The plant comprises two 2 000-kilowatt alternators and the current which is generated at 3 450 volts, is stepped up to 46,000 volts for the line

In a recent number of the Electrical World appears an interesting article on the wireless telephone and the author arrives at the following conclusions "It is, then quite evident that future systems of wireless telephony must either eliminate the use of microphone transmitters or find types far in advance of those used to-day In addition to this, some more powerful and more reliable oscillator must be substituted for the arc If no great difficulties arise in its operation and its cost be sufficiently reduced this substitute may be the high frequency alternator With the few weak points of the present system removed and the useful parts of the apparatus retained, the wireless telephone will come into all the uses to which it is adapted but the elimination of the defects will involve a departure from present methods Until these are discarded, attempts at commercial wireless telephony will be futile"

The following useful electrical shop kink was published in a recent number of the Electric Railway Journal describing a method of soldering broken or burned-out wires without removing them from the armature "The damaged wire is raised a little way out of the slot. The insulation is then scraped off for a few inches and the ends of the broken wire are filed off smoothly after which a piece of wire is cut to fill the gap One end of the inserted wire is then butt-ended with the armature wire and the ends heated by a gas torch until they are red hot Upon this a little borax is applied as a flux, and then some silver solder is inserted between the ends. When both splices are completed in this fashion the bare wire is wound with silk, as the latter takes up less space than tape After the silk has been covered with insulation the coil is ready to be returned to the slot During the operation of heating with the torch the adjacent wires are protected by fiber barriers"

It is reported that at the time of the rescue of the crew of the steamship "Kentucky" by the "Alamo," which had been summoned by wireless telegraphy, the wireless apparatus had almost been put out of commission by the water that partially submerged the dynamo. By wrapping the dynamo with tarpaulins it was possible to keep the machine running until help arrived This is not the only case of a rescue due to the help summoned by wireless telegraphy, and on a previous occasion the apparatus was put out of commission by the encroachments of the water It has been suggested that storage batteries should be used to supply the current, because they could be placed where there would be no danger of injury by water But as storage batteries would be impractical owing to the motion of a vessel in a storm, some arrangement should be provided for placing the dynamo and a gasoline engine for driving it well above the danger line.

SCIENCE.

Recent experiments have proved conclusively that coal dust which has been ground to a state so fine that it will pass a 200-mesh sieve, will explode from contact with either a naked flame or with the arc of an electric current

The building of an observatory on the rim of the great crater of Kilauea has been advocated for several years. The prospects are now brighter than they ever were, and it seems likely that the observatory will be built as part of the College of Hawaii

A recipe for a non-shrinking alloy to be used in duplicating patterns, is given as follows by The Metal Industry Tin, 50 pounds, zinc, 50 pounds This gives a tough hard metal that runs well if a good grade of zinc is used The addition of 2 pounds of bismuth will render it even more fluid and enable it to be poured at a lower temperature By using heavy sprues and pouring cold the shrinkage which is slight, may be largely overcome

Prof. E E Barnard recently obtained a photograph of Halley's comet showing a tail one degree long The comet is beginning to wake up Mr Ellerman will sail for Honolulu on March 8th to observe the transit of Halley's comet across the sun's disk He is sent out by the comet committee of the Astronomical and Astrophysical Society of America He takes with him a good 6-inch portrait lens by Brashear and a 6 inch equatorial mounting lent by the Lick Observatory He is perhaps the best possible man for the work, and will be thoroughly equipped to obtain the best results

During the night between October 7th and 8th, 1909, a meteoric stone fell to earth on the farm of Mr W P Nickerson, of Norwood Mass The meteorite is a ham shaped mass of very hard gray stony material, much corrugated on the surface, about two and one-half feet long in its greatest dimension one foot to nearly one and one half feet broad and varying from one foot to one-half foot in the third dimension Its volume was estimated as about 1 75 cubic feet its weight as perhaps 275 pounds, and its density as not much over 2 5

Besides Halley's Comet two other comets may be expected in 1910 The first of these is Tempel's, discovered July 3d, 1873, at Milan It has a period of 5 75 years It was observed in 1878 1894 1899 and 1904 It last passed perihelion in November It ought therefore, to be expected this spring

The second of the expected comets is that of Arrest, discovered in 1851 and the return of which is expected in the summer of this year It was observed in 1857, 1870, 1877 1890 and 1907 It was unfortunately placed in 1903 and therefore could not be observed

The chief purpose of the sound proof room at the University of Upsala is the insuring of perfect freedom from sounds from outside By building it on platforms of thick lead and cement and by constructing its walls of many thicknesses of felt, cork, asbestos, and other bad conductors of sound vibrations, the principal object was attained The room is so quiet that the beating of one's heart or the creaking of one's muscles is at once heard on taking up a position within its closed doors and windows and the only defect of it as a laboratory for acoustic experiments is that ventilation is absent, and no one can remain in it for more than an hour at a time

Prof Lipmann announced before the Academy of Sciences that Madame Curie has obtained a tenth of a gramme of polonium with which she has been experimenting Polonium is a radio-active element discovered by Madame Curie as early as 1898 but not obtained before in sufficient quantities for elaborate experimentation From the brief reports which have been received it would seem that polonium in its earlier stages is more radio-active than radium, but it loses its power very much more rapidly It seems reasonably certain that polonium is identical with radium F, one of the series of metals produced by the decomposition of radium The particle of polonium obtained by Madame Curie is not entirely isolated, but was combined with several tenths of a milligramme of another body

A special investigation of the motion of the bridge of the violin has been made by J W Giltay and Prof M De Haas of Amsterdam They conclude from their experiments that the bridge of a violin performs a parallel as well as a transverse motion, and that the timbre of the tone is modified greatly when the intensity of one of the motions is altered and the other motion is left unchanged as nearly as possible They have also explained the action of the mute, and the influence which the use of too thick or too thin a bridge has on the sound of a violin The mute is commonly supposed to "dampen" or "deaden" the sound If the mute caused nothing but a general damping by reducing the bridge motion, the mute would only weaken the sound, and the same effect would be obtained by bowing softly on a violin without a mute as by bowing hard on a violin with a mute That, however is by no means the case, as every one knows.

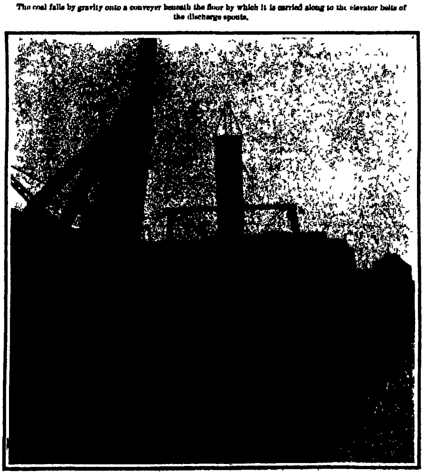
A NEW TYPE OF SELF-DISCHARGING COALING VESSEL

BY F. C. COLEMAN

The new system of belt-conveyor discharge has been installed by William Doxford & Sons, Ltd., in a new vessel—the steamship "Pallion"—which they have recently built at the Pallion shipyard, Sunderland, England, to the order of the Dunrobin Shipping Company, Ltd. of Newcastle-on-Tyne. This vessel has a length between perpendiculars of 270 feet, and a carrying capacity of 3,100 tons on a 17 feet 10 inches draft. The machinery, comprising triple-expansion engines and multitubular boilers is placed aft. The cabin accommodation is fitted in the bridge and the crew space in the forecastle, while the navigation accommodation is about midships. The inner bottom is raised and sloped upward in the wings and built into the sides of the vessel forming a suitable incline for gravitating the cargo to the conveyers, and also giving the vessel the advantage of being about half loaded when in ballast and bunkers. In the center line is constructed a slope-top fore peak throughout the hold and between this tunnel and the tunnel extending from the engine space to the raised portions of the double bottom are placed the conveyer belts of the Robins pattern one on either side of the vessel. The sides of the tunnel below the level of the hatchways over the belts are open for free access to the belts and carriers at all times. Over these conveyor belts are placed strong iron guide plates extending the full length of the hold and partially covering the belts leaving a 24-inch hatch over a 36-inch belt. This space is covered in the holds by cross-laid hatch covers, 9 inches in length and 3 inches in thickness, which support the cargo and leave the conveyors to work without carrying the load. At the after end of the hold a portion of the hatch, over which the 9-inch hatch cover is omitted is covered by a horizontal iron slide door operated by a ratchet in the tunnel. On the foreside of the bulkhead is constructed an access chamber in free communication with the tunnel which is of such a form as partially to protect the slide door from the cargo when loading, and in the floor of this projection of the chamber is fitted a flap hatch to give access to the hold from the tunnel. At the after end of the cargo space the conveyers rise from the horizontal and pass upward in iron chambers through the machinery space, and thence into the conveyer-driving engine room and discharge the load into guide shoots in the stern of the vessel. These carry the load on to return belts, which are extended forward both sides on the deck. In a simple form these conveyers would terminate at the fore end of the machinery space, or poop front and the load would be delivered into side shoots which telescope and are adjustable for loading barges on either side of the vessel, the shoots being suspended from derricks or other suitable means. In cases where the discharge is required at a higher level than is attained at the poop front and a large range of elevation is necessary, as for instance, for delivery on high quays into trucks and into barges alongside, the conveyors are carried forward and hinged at the poop front, and the delivery end is suspended by suitable tackle from twin masts or framework, and is raised or lowered according to circumstances, delivering the load into telescopic shoots suspended therefrom. When the delivery is into trucks, the "offside" belt delivers amidships into a cross conveyor suspended on the masts, which carries the load to the shore side and delivers by shoots into the trucks. A development of this principle has, however, been applied to the steamship "Pallion," as, in order to obviate the use of delivery shoots, which results in considerable damage, the terminal conveyors are carried in swivel booms, which are raised or lowered and swung overboard to the points of delivery, thus permitting of the cargo being conveyed direct to the truck or barge without shoots. These booms may also be swung across to the reverse side of the vessel, so that both booms can deliver simultaneously into trucks or warehouse. Another important feature of this discharging arrangement lies in the method of delivering the cargo onto the belts from the hold, and enabling the operator to have full control and free access at all times to the conveyers and to the face of the cargo. He may thus superintend and direct the continuous flow, and be in a position promptly to correct any tendency of the cargo to bridge or to choke the aperture leading to the belt, which, being the smallest space the load has to pass through, insures a continuous and uninterrupted delivery.

View of the hold.

The coal falls by gravity onto a conveyer beneath the floor by which it is carried along to the elevator belts of the discharge spouts.



The coal is taken from the bottom of the hold and discharged at an elevation of 40 feet above the water by conveying and elevating belts operated on the ship. Rate of unloading 500 tons per hour, cost two cents a ton.

A NEW TYPE OF SELF-DISCHARGING COALING VESSEL.

The unloading of a cargo of coal is carried on as follows. Presumably the holds are full and the cargo lying solid, except under the overhang of the chamber on the bulkhead over the slide door, at which point the space is naturally only partially filled. The slide door in the covers over the conveyers is drawn back by the operator in the tunnel, and the loose coal over it immediately travels on to the conveyers, which may or may not have been started. If running, then the flow continues; if standing, no difficulty arises because the conveyer is only filled at that point, and the aperture becomes blocked and only clears and flows when the belt is started. Then, if no "bridging" occurs, the after part of the hold is rapidly emptied on to the conveyer which is carrying it on deck and into the receiving trucks or barges. If, however, any "bridging" is threatened, the operator in the tunnel ascends to the chamber, and has free access over the aperture to correct any block. If "bridging" occurs higher in the hold, then he breaks it by means of a pinch bar through perforations in the chamber sides. When the after end of the cargo has run to its natural angle of repose, the operator now in the hold merely removes the first cover and places it aft of the aperture allowing another portion of cargo to run, he being in a free position to maintain the run and correct any tendency to bridging and to abnormal rushes. If such do occur and incline to block the aperture, he again corrects this and, having run so much more, he removes the next segment of cover, and so on, gradually transferring the aperture from the after end to the fore end of the hold. The wing tanks and central tunnel being sloped, the cargo gravitates to the aperture, and the finals are manipulated by the operator, one man being on each side of the hold. An important feature is the inclined shoot, over which all the cargo passes on to the belt. This shoot is carried on travelers on the guide plate sides, and is moved by the operator in the hold forward from stop to stop to correspond with the movement of the aperture thus allowing two men to manipulate a whole cargo at the rate of 500 tons per hour. It is estimated that in regular working the steamship "Pallion" will be unloaded in six hours, or allowing for stoppages in moving barges, etc., seven to eight hours, and this too with but one stoker, one engineer, two laborers in the hold, and two adjusting the shoots or booms into the craft. The total cost of discharging the cargo of the "Pallion" will not exceed $60, including the upkeep of the gear, and it is affirmed that the cost of discharging a similar cargo at, for instance, the port of Hamburg, is about $560, and that in the work no fewer than 110 men are employed for about eleven hours under favorable conditions.

A steamer such as the "Pallion" is independent of shore labor, and so may avoid the frequent delays arising from labor troubles. The number of men required is so small, and the time occupied so short, that it would be a simple matter to agree with the crew of the vessel that they receive a fixed extra wage, and the discharge of the cargo become part of their ordinary duty. A liberal estimate of the cost of discharge, under such conditions, would not reach the sum of two cents per ton; and at this cost the cargo is also weighed.

Roof Paint.—Mix 35 parts of powdered clay slate, 20 of powdered mica slate, 35 of powdered American rosin, with half the quantity of pure coal tar and boil until an easily brushable mass is obtained.

NOVEL ELECTRICAL APPLIANCES

BY PERCY COLLINS

The largely increased use of electricity for illuminating distilleries, wine-cellars, etc., has rendered obsolete many appliances which were formerly in use—especially those which consume coal-gas when in operation. Hence arose a demand for up-to-date inventions designed to meet the conditions imposed by progress. Few recent patents illustrate more strikingly the manner in which the ingenuity of mankind keeps pace with the exigencies of modern trade than those which are illustrated in the accompanying photographs. The patentee and manufacturer of these original electrical appliances is Mr Frederic Hughes, of London, England, and it is to this gentleman that the present writer is indebted for permission to describe and illustrate the apparatus in question. In the case of the electric search-light or cellar-torch, Mr Hughes claims that the appliance stands alone, being the only perfect, clean, odorless and reliable invention for thoroughly examining brewers' casks, vats, refrigerators, spirit or oil jars, etc.

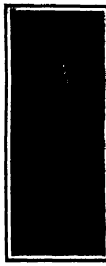
The main details of the cellar-torch may be appreciated by reference to the accompanying photographs. The reader will see that it consists essentially of a powerful electric glow lamp of peculiar design, supported at the end of a suitably curved rod The circumference of this lamp is so small that the appliance can be used effectually through any orifice not less than half an inch in diameter

The advantages of this new cellar-torch will be most readily perceived if we compare it with the older appliances which it has superseded The contact of a gas jet, or a taper flame, with a cold surface (such as the inner wall of a cask or jar) immediately produces a deposit of soot, which may be too slight to attract the notice of the searcher, but will nevertheless discolor and injure to a greater or less extent the fluid with which the vessel is ultimately filled Similarly, when gas is used to "nose" casks, the products of combustion combined with the CO_2 already in the cask and the pungent odor involved conceal the mustiness and thus deceive the examiner, who accordingly certifies as clean a vessel which, as a fact, is far from being so With the patent searchlight or cellar-torch the examination may be prolonged indefinitely without in the least affecting the actual odor of the vessel's interior

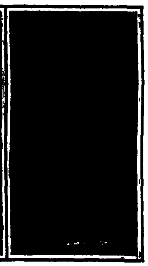
As the heat generated by the lamp of this cellar-torch is very slight, the appliance may be employed for the examination of vessels containing all kinds of inflammable fluids or gases without the smallest risk of explosion. Each torch may be fitted at will with an oblong or circular mirror, which is screwed to the extremity of the appliance beyond the lamp Upon being passed into the jar or cask, a slight pressure against the side or bottom of the vessel causes the mirror to assume a horizontal position, and by this means a view of the *under* surface of the vessel is readily obtained The advantages of this device will be at *once* apparent to the practical reader, who will readily perceive that by no other means can the whole interior wall of a closed vessel be so thoroughly explored Indeed, for the thorough examination of the interiors of bung staves, bushes, boiler tubes, etc., there is no more perfect appliance obtainable than Hughes's cellar-torch fitted with a reflector of suitable shape

In conjunction with his patent electric torch, Mr Hughes has recently introduced another novelty in the thermo-cere or wax-melter This is an ingenious appliance by means of which a perfectly controlled supply of melted sealing- or bottling-wax may be obtained. Like all the most important patents, the apparatus is simple in design and effective in use. When connected by means of the flexible wire with the source of electrical current it is held in the left hand—the right hand being perfectly free for use A stick of wax is fitted into the holder and held in place by means of a screw clip. The left thumb (overcoming a spring) presses the wax downward against the heating receptacle, and by slightly inclining this the melted wax flows through a lip on to the letter, bottle, or other object which is to be sealed Of course, as the wax melts, the stick shortens, and to complete the melting of the entire stick a slight movement of the hand downward on the handle enables the thumb further to press the wax until the whole stick is consumed—the wax holder traveling in a grooved socket.

Whenever it becomes desirable to check the flow of melted wax, the pressure of the thumb is relaxed, when the spring causes the wax to rise just sufficiently to free it from the heating plate. A few of the advantages of the thermo-cere may be enumerated. In the first place, the appliance may be used in the most confined space, and in any circumstances, with absolute safety from the fire risk which is so constant a danger wherever naked gas jets and flexible rubber tubes are employed. Again, the greatest possible economy in the use of wax is obtainable, there being no possibility of waste through carelessness, for the reason that melting is automatically stopped the instant that the appliance leaves the hand No discoloration or smoking of the wax is possible, and the most delicately tinted sealing-wax will remain perfectly true to the original shade Finally, the sealing can proceed continuously, and in any position, the appliance needing no preliminary preparation, while all splashing or dropping of the wax is entirely avoided The thermo-cere may therefore be used for sealing letters, postal packets, etc, while articles of value may be safely left in close proximity without the slightest risk of their catching fire

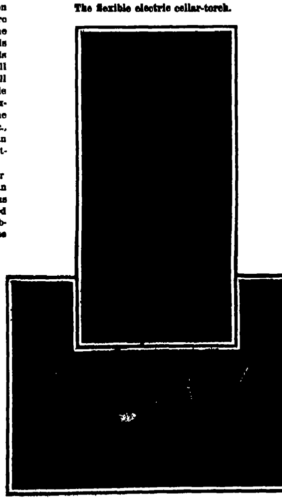


Wax melter in use, sealing bottle cork.



The electric wax melter.

The flexible electric cellar-torch.



Cellar-torch heads, showing lamp and mirror (detached).

NOVEL ELECTRICAL APPLIANCES.

The New Agricultural Fertilizers.

The manufacture of fertilizers is one of the most important of chemical industries, but this manufacture, together with the exploitation of the nitrate beds of Chile and the potash deposits of Stassfurt, is now in a critical stage of development, owing to the increasing production of nitrogenous fertilizers by the fixation of atmospheric nitrogen, and also to the results of recent experiments on the fertilizing effect of extremely minute quantities of totally new agents. The properties of both classes of these new fertilizers are briefly described by René Vallier in Revue de Chimie pure et appliqueé.

I NITROGENOUS FERTILIZERS OBTAINED FROM THE ATMOSPHERE.

Nitrates Neutral nitrate of lime, containing 13 per cent of nitrogen, has been manufactured at Notodden, Norway since 1905 It is an excellent fertilizer and equal in all respects to Chile nitrate It can be mixed with superphosphate without causing appreciable loss of nitrogen or retrogradation of phosphoric acid Its hygrometric character makes its application somewhat inconvenient, but it possesses, in contrast with Chile nitrate, the advantage of adding to the soil lime, an indispensable plant food, instead of soda, the accumulation of which may be injurious to vegetation

It appears probable that Chile saltpeter will, before long, be supplanted by nitrates obtained from atmospheric nitrogen The Birkeland Eyde and other processes now in use are commercially practicable in their present form, only where water power is cheap, but these processes are susceptible of great improvement An efficiency equal to that of most other processes of industrial chemistry would make it commercially feasible to produce nitrates everywhere At present the nitric acid obtained from the air is neutralized with lime, while most of the world's production of sulphuric acid is employed in the manufacture of superphosphates If this nitric acid could be used to convert the tribasic calcium phosphate into the superphosphate an enormous saving could be effected and a fertilizer produced which would contain both soluble phosphoric acid and nitrogen in a form suitable for assimilation, and would drive every other nitrogenous or phosphated fertilizer out of the market.

Cyanamides The difficulty of applying the light cyanamide powder has been overcome by adding a little water, which combines with the quicklime of the crude cyanamide and forms a coarse powder called granulated cyanamide which is much more convenient in use A still better form is oil cyanamide, made by mixing the fine powder with 4 per cent of crude petroleum The proportion of nitrogen in commercial cyanamide has been increased by improvements in manufacture from 15 per cent to about 20 per cent, that of pure calcium cyanamide being about 35 per cent Cyanamide has now fairly entered into agricultural practice The trust which controls the sale of the product in Germany and Italy sold 3,000 tons of cyanamide in the first half of last year

Calcium cyanamide (CN_2Ca), treated with water and carbon dioxide yields dicyanamide ($C_2N_4H_4$) in the form of nearly insoluble colorless crystals, which contain 66 per cent of nitrogen and form the richest nitrogenous fertilizer ever produced In some cases the cost of production of dicyanamide may be counterbalanced by the economy in transportation Applied to wheat in the quantity of 30 or 40 pounds per acre, it has produced excellent results

Guillin has proved that more than one-fifth of the nitrogen of cyanamide is converted into ammonia in one week and more than one-third in two weeks, by the action of soil moisture Muentz and Nottin observed in two months a production of nitric acid corresponding to 11/12 of the nitrogen of the cyanamide added to the soil

The poisonous action on plants which was at first attributed to cyanamide fertilizers appears to have no existence or to be due to impurities The germinating power of wheat treated with pure cyanamide or dicyanamide is not diminished but is sometimes increased Muentz and Nottin however, observed a temporary arrest of growth after the application of cyanamide in hot dry weather, and therefore advise the selection of a wet period for its application

II FERTILIZERS CONTAINING MANGANESE

Manganese is widely distributed in nature and plays an important part in the formation of the diastases which are the principal agents in vegetable synthesis Nagaoka, in Japan applied manganese sulphate to rice plantations in quantities equivalent to from 10 to 50 pounds of Mn, O, per acre, and obtained increases of crop of from 22 to 37 per cent. The beneficial effect persisted to a smaller extent, through the following year Manganese chloride, a waste product of the chlorine industry, exerts a similar action.

In Europe, Voelcker and others have obtained increases in the crop of wheat up to 20 per cent from the application of from 25 to 50 pounds of manganese sulphate per acre. Excessive doses (100 pounds) diminished the crop. Similar results were obtained with oats.

Grégoire, Hendrick and Carpiaux observed little benefit from the application of manganese to sugar beets, but Gasola obtained increments of 46 per cent in roots and 26 per cent in sugar from manganese chloride and of 24 per cent in roots and 55 per cent in sugar from manganese sulphate—the chloride diminishing and the sulphate increasing the richness of the juice.

With flax Garola obtained the surprising increase of 54 per cent in totally dry weight from manganese chloride, and 31 per cent from manganese sulphate. He concludes from his analyses that the manganese applied is assimilated by the plants and that the difference in molecular weight of the chloride and sulphate determines the degree of influence on the formation of diastases.

But the effect cannot be wholly due to the manganese which is assimilated, for Bertrand found no more manganese in oat plants, the growth of which had been increased by manganese, than in the control plants to which no manganese had been applied. And recent American experiments have proved that fertilizing agents act partly by destroying the toxins left in the soil by the preceding crops. Unstable manganese salts might be expected to promote the oxidation of these toxins. Manganese oxide, traces of which occur in most soils, is entirely inert. The greatest proportion of successes has been obtained with manganese sulphate.

III. STIMULANTS AND POISONS.

American experimenters have revived the old theory of De Candolle, and proved that infertility may be due to poisonous excretions. It is conceivable that minute doses of powerful poisons might destroy these excretions or prevent their formation.

Copper Salts. The salts of copper have long been employed for the purpose of destroying fungous parasites of the grape, and fields of young grain can be freed of certain noxious weeds without injuring the grain plants by spraying with a 5 per cent solution of copper sulphate. Quite recently Bréal has increased the yield of maize by from 27 to 86 per cent by soaking the seed corn in a copper bath and then drying it before planting. The bath was composed of 3 parts by weight of copper sulphate, 30 parts of starch and 1,000 parts of water.

Zinc. Javillier, inferring, from the presence of zinc in many plants that this metal must perform some function in vegetable physiology, made an extensive series of experiments which proved that infinitesimal quantities of zinc promote the growth and multiplication of mold and yeast fungi and some chlorophyl-bearing plants. For example the growth of a certain mold was stimulated by cultivation in a medium containing 1 part of zinc in 50,000,000, the maximum increase was produced by proportion between 1 in 10,000,000 and 1 in 25,000 and still stronger solutions exerted an unfavorable or toxic influence. Micheels and De Heen find that zinc salts promote the germination of wheat.

Alum. The large proportion of alumina found in the ash of certain exotic plants (more than 50 per cent in the Australian tree *Orites excelsea*) led Yamano to try the effect of aluminous fertilizers. Common alum, added in the proportion of 1/5 per cent to the water in which young barley plants were growing quickly killed the plants, but proved much less injurious to barley growing in the ground. A distinct fertilizing effect, manifested by increase of crop was observed to follow the application of 1/20 per cent and 1/500 per cent solutions of ammonia alum to barley and flax, the effect of the ammonia having been carefully eliminated.

Magnesia. The presence of magnesia in all plants and in all soils long ago suggested the employment of magnesia as a fertilizer. Tribot's recent study of the influence of magnesia in the transformation of saccharose proves that magnesia can act as a ferment. Magnesian fertilizers were formerly employed, to some extent and with good results. In recent experiments magnesia has been found to increase the crop of grain, potatoes and beets chiefly by promoting the assimilation of nitrogen.

Bromine. Aso finds sodium bromide stimulating in very small doses and poisonous in larger doses to beans growing in pots. One part of bromide to 50 million, 5 million and 1 million parts of earth produced increases of crop of 93, 48 and 29 per cent, respectively.

Iodine and Fluorine. Potassium iodide, applied in dilute solution, appears also to act as a stimulant or a poison according to the dose. Aso and Suzuki obtained a large increase in crop of rice from about 1 40 pound of the salt per acre but very little increase from ¼ pound while Hollrung diminished the crop of sugar beets by one-fourth by applying about 4 10 pound per acre. Analogous results were obtained by the same experimenters, with sodium fluoride, applied to the same crops.

Rare Elements. Cerium, like manganese, appears to act as a ferment. Aso finds thorium rather injurious than beneficial to vegetation. Nakamura has increased the yield of rice, growing in pots, by 70 per cent., by mixing with the soil 1 100 000 of its weight of lithium carbonate, but a dose 10 times greater produced a smaller increase (55 per cent), caesium carbonate, in the same doses, produced increases of 13½ and 9 per cent.

IV. BACTERIAL FERTILIZERS.

The discovery of the mechanism of nitrification and the fixation of atmospheric nitrogen by the bacteria of root nodules, soon led to attempts to aid the process by the addition of nitrogen-fixing bacteria. In 1895 Nobbé and Hiltner patented a process of inoculating peas and beans and the soil in which they grow by soaking the seed with an infusion of a gelatin culture of the bacteria of the root nodules. Bayer offered a pure culture of Ellenbach's bacillus, mixed with potato meal, but Maerker soon concluded, from the contradictory results obtained, that the preparation had failed to prove its value. In 1904 the United States Bureau of Agriculture distributed 12,000 boxes of bacterial cultures, which appear to have produced good results, in the majority of cases.

But the effect of these preparations is uncertain, as the abrupt change of medium may avert the development of the bacteria. The soil naturally swarms with nitrifying bacteria, but their growth may be checked by various causes which will have the same effect on the few millions that are added.

Stocklasa has endeavored to obtain hardier varieties by cultivating the bacteria in a large mass of earth, and has obtained remarkable results, but in view of the uncertainty mentioned above, it is prudent to defer judgment until several more years of experiment have elapsed.

V. THE VALUE AND THE FUTURE OF THE NEW FERTILIZERS.

The value of the nitrogenous fertilizers obtained by artificial methods has been abundantly and decisively proved, but the same statement cannot be made in regard to the other new fertilizers every one of which has given contradictory results in the hands of different experimenters. Similar uncertainties, however, attended the early experiments with other chemical fertilizers the value of which is now universally recognized. We have learned how to use nutrient fertilizers and we shall learn how to use stimulants. And this knowledge will be productive of incalculable benefit to agriculture.

Charcot and the Antarctic.

Lest anyone should suppose that Dr. Charcot went to the Antarctic largely for the purpose of reaching the pole it may be said at the outset that his chief object was one of scientific research only. He only reached latitude 70 degrees, and therefore can hardly compare in achievement with his predecessors, and notably with Shackleton and Scott. What he did was to explore a region of archipelagoes and waterways, of which very little is known, and to broaden our knowledge of an ice barrier which extends westward from the South Shetland Islands unbroken.

Although Dr. Charcot returns with none of the laurels of Shackleton and Scott, his explorations will be of much assistance to future Antarctic explorers. From the meager account of his findings it would seem that any attempt to approach the pole by way of the straits of the South Shetland Islands is doomed to failure, and that Commander Peary's plan of attacking the pole in a direction opposite to that pursued by Shackleton is hopeless. So far the only starting point that holds out any promise at all is the base of Ross's ice barrier, where the volcanoes Erebus and Terror are to be found. Here and here only can an expedition winter not more than a few hundred miles from the pole.

The Current Supplement.

The current SUPPLEMENT, No. 1782, contains some very striking illustrations of the Paris flood, which show to what extent the capital of France has suffered from the inundation. Mr. H. F. Stimpson contributes an excellent article on efficiency in shop operations, in which he shows how shop efficiency can be increased, as well as some results secured by the methods which he advocates. Mr. Claude Grahame-White, in an article "Some Experiences of an Aviator," sketches his own experience, and thus shows many an aspiring aviator what he has to avoid. Another paper on explosives for use in coal mines by Munroe and Hall is presented. The second and concluding installment of the article on the Wright injunction, containing extracts from the court's opinion and the briefs is published. E. P. Buffet concludes his splendid biography of Leonardo da Vinci, in which he pays a tribute to that great man's engineering ability. When the Nobel Prize was awarded to Mr. Marconi, he read a paper at Stockholm, in which he summarized the recent development of wireless telegraphy. That paper is published in the current SUPPLEMENT.

An Injunction Against Paulhan.

Judge Hand, in an opinion filed in the United States Circuit Court, granted the injunction *pendente lite* asked for by the Wright Company against Louis Paulhan, the French aviator, alleged to be using in his exhibition flights here a machine which is an infringement of the patents granted to Orville and Wilbur Wright. This decision prohibits Mr. Paulhan from using his machine in this country pending the trial of the Wrights' suit against him.

After discussing the prior discoveries cited by the defense, Judge Hand in conclusion says:

"It is, of course, unusual to grant a preliminary injunction before any adjudication and without any acquiescence. However, when the right is not seriously attacked, and when the infringement is clear, the court should not hesitate to interfere.

"From the showing made I cannot doubt that the complainants first put into any practical form the system of three-rudder control. That there may be other systems is not the point, let the defendant use those if he will. Nor is it necessary to conclude that the complainants were the first to fly. Upon that I decide nothing whatever, for it is not an issue in the case.

"All I do say is that I cannot find that anyone prior to their patent had flown with the patented system, and that the changes from the specifications which the defendant had made are no more than equivalents which do not relieve from infringement.

"It is quite clear that for the complainants' protection a writ must go *pendente lite*, because the defendant, being a non-resident, who is here transiently, there is no way in which they may insure themselves of the monopoly they have acquired except by preventing his use of it at once."

A Library in the Sahara.

The French Colonel Gaden, who recently led an expedition into the southwestern region of the Sahara, found in the course of his investigation that one of the most powerful princes there, the Sheik Sidia, was the founder and possessor of a rather large library, a report of which is published in the latest number of the Revue du Monde Musulman. This library is small, indeed, when measured by our ideas of such a foundation, for it contains only 683 books and 512 manuscripts. Still it not only proves that a most urgent need of books has seized the most distant outpost of Mohammedan cultivation, but also provokes most lively interest in consequence of its composition.

Approximately the books comprise thirty groups relating especially to koranic erudition, the doctrine of faith, history, jurisprudence, philology, travel and discovery, poetry and fiction, married life, magic recipes, interpretation of dreams and astrology. The library, therefore, bears the impress of sheer orthodoxy, which is further manifested by its lack of books from forbidden provinces, such as philosophy and the natural sciences, but already the existence of printed books, the production of which is deemed a rigorous contradiction of the strict tenor of the Koran, proves that the revolution in the production of books, which began in Stamboul toward the end of the eighteenth century, has to-day acquired citizenship in the whole Islamitic world, and that at no remote day also in this circle of culture and of passionate political aspiration and achievement the printed book will force the written book into a very dim background. Islam, long obstructed by crass ignorance of many foreign things among them books especially, which could have exercised a most beneficent influence on its daily life, is now quickened by the frequent book in its own tongues, which comes galloping from European publishers even into the precincts of its haughtiest orthodoxy. The printed book is already an irresistible leaven in Islam.

Death of Alfred Spear.

Alfred Spear of Passaic, N. J., died at his home in his 87th year. He was one of the first who ever conceived the idea of a moving sidewalk. His model interested such men as Peter Cooper, Horace Greeley, and several other prominent men. The scheme had so much to commend it that two Legislatures, those of 1873 and 1874, authorized the use of his sidewalk, but the Governor of the State vetoed the bills.

The Sensitiveness of the Telephone.

Preece has calculated that an audible sound is produced in a telephone by a current of 6 by 10^{-13} amperes, and Pellat has calculated that a sound is produced by a difference of potential between the two stations, amounting to only 1-2000 volt. These statements give some idea of the great sensitiveness of the modern telephone, but the sensitiveness of the human ear, which perceives the invisible vibrations of the telephone diaphragm, is no less remarkable.

Correspondence.

HOW A TROLLEY CAR REVERSED ITS POSITION.

To the Editor of the Scientific American

On January 20th, 1910, about 12.40 P M, a curious and unique accident happened in regard to limited car No 230, D. and F, at the crossing of Main and Ash Streets, Piqua, Ohio. The phenomenon was so remarkable that I have concluded to make this report of it, and if you see fit you may lay it before your readers.

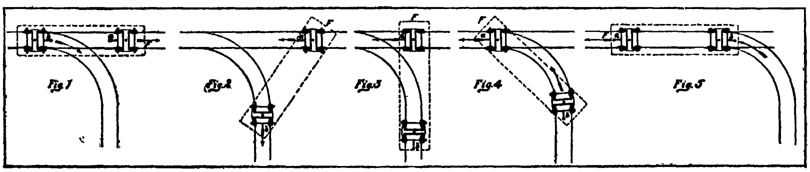
The car was headed south on Main Street, running perhaps ten or twelve miles per hour At the switch in Ash Street, where connection is made with the city line, the rear truck left the main line and followed the Ash Street line, and the car body turned completely end for end, returning almost completely to the main line. Neither truck was at any time off the rails and even the trolley wheel was still in working contact with the over-head wire when the car stopped The brake rod connections were all stripped and torn loose, also the wire connections from controllers to motors were severed No one was seriously injured, and a casual observer coming on the scene, as the writer did, a few minutes after the occurrence would not notice that anything out of the ordinary had transpired

The attached diagram shows five positions assumed by the car in its wonderful evolution The relative position of the truck with reference to the body and also to the tracks is shown, the end of the truck normally positioned toward the center of the car body being indicated by *a* and *b* The end of the car headed south before the accident is indicated in each figure by *F*

Fig. 1 indicates the status of things when the truck *b* is about to turn from the main line. Figs. 2, 3, and 4 show intermediate positions, and Fig 5 the car when it came to rest

E. B Rayner.

Piqua, Ohio.



[The mere momentum of the car would not account for the return of the car to the main line The fact that the trolley wheel remained on the line suggests that the motorman must have reversed the rear motor, which acted to push the car back in the reversed position to the main line.—Ed.]

MISS PECK REPLIES TO MRS. WORKMAN.

To the Editor of the Scientific American

Having observed in your issue of February 12th a letter in reference to the altitude of Mount Huascarán and my record from Mrs. Workman, may I state my own position a little more definitely?

After making the ascent of Mount Huascarán, north peak, September 2nd, 1908, of which I brought back absolute proof in the shape of photographs, I gave my reasons for believing the mountain to have an altitude of 24,000 feet, although on account of the high wind I had been unable to take hypsometric observations on the summit.

Naturally, I did not expect the scientific world or anyone else to regard my estimate as an exact measurement. If anyone did so, I cannot be responsible

It was, of course, quite within the province of any one to take so great an interest in the matter as to spend some thousands of dollars in sending engineers to Peru to make a triangulation of the mountain, and to publish this as the absolute height of Huascarán

There is, however, something to be said in regard to the accuracy of such triangulations. Permit me to quote from the recent work of Mr A. L. Mumm (of the English Alpine Club), "Five Months in the Himalayas"

"The results of triangulations do not always agree and even when they practically coincide, they cannot be accepted as absolutely unimpeachable There is good reason to suppose that the effect of refraction is not yet sufficiently understood for the allowances made for it to be perfectly accurate and the higher and more remote the summit, the larger is the possibility of error Bearing these facts in mind, it will be apparent that anyone who starts to form a decided opinion as to what persons are entitled to the honor of having reached the highest elevations has a very pretty tangle to unravel And I will leave it at that. Longstaff [who made the ascent of Trisul, 23,406 feet] lays no claim to any record, and goes out of the way like a good sportsman to establish the record of a predecessor"

Another disinterested authority is Dr. Norman J. Collie (also of the English Alpine Club), who has had much experience in the Himalayas and who stated to Prof H. C. Parker that the amount to be allowed for refraction on high snow mountains was most uncertain, that therefore the altitude of the great Himalayan peaks, though given in precise figures, was still in doubt

Furthermore, I once met a former member of the British Royal Engineers who told me that the triangulation of the well-known mountain K² recently attempted by the Duke of the Abruzzi, was made by a friend of his, whose allowance for refraction was double what he thought should have been made With the smaller allowance K² would be about 4 000 feet higher than it is now regarded

It is therefore obvious that if similar allowance for refraction is made on Huascarán, it may easily happen, especially in a country with a much drier atmosphere than India that the mountain is 1,000 or 2,000 feet higher than has been figured

Accordingly while it is perfectly proper for all who desire to do so to accept the figures of the triangulation, regardless of the careful estimate of myself and of the Swiss guides and of the evidence of the photographs, no one need feel *obliged* to accept those figures as final.

As to Aconcagua being the highest of the Andes, I may say that aside from Huascarán there are several mountains which may prove when carefully measured to be of greater altitude than Aconcagua

In this connection it may not be wholly out of place to say that while Mrs Fanny Bullock Workman has, according to the newspapers frequently announced her readiness to furnish evidence of the altitudes claimed by herself, when I wrote to her stating that I should be glad to see the figures of her observations, an interest shared by some other Alpinists she informed me that they had not been published in any of her writings, nor did she offer to give them to me personally

Annie S Peck

New York, N Y

The Aeronautic Show at Boston.

The first exhibition of aeroplanes, balloons, and aeronautic apparatus exclusively to be held in the United States was held in Mechanics Hall Boston, Mass, from the 16th to the 23rd instant This first Aeronautic Show, although fairly representative of the different experimenters, was somewhat of a disappointment in that there were no motor-driven heavier-than-air machines exhibited that have actually flown, while 50 per cent of the power machines were shown without motors This fact however, did not deter one from getting a good idea of the design and construction of the aeroplanes proper

The question of reliable light weight motors at a reasonable price *is still a burning one, and a fortune* awaits the man who will produce such motors—of 25 and 50 horse-power respectively—to supply them to aviators upon easy terms Eight different makes of motors were on exhibition, three of these (Curtiss, Cameron, and Harriman) being of the 4-cylinder 4 cycle type, two (Waterman and Duryea) of the 4-cylinder, 2-cycle type, and two (Easton Cordage Company and Buffum) of the 4-cycle, 8-cylinder and 12-cylinder V type respectively An Elbridge 3-cylinder water-cooled 2-cycle motor was also shown on the Wright type biplane of F P Schneider The 25-horse-power 4-cylinder Duryea motor which was shown upon the Bleriot type monoplane of Stanley Y Beach, is air-cooled by means of thin copper strips wired to the cylinders. The Cameron motors—a 4 and a 6-cylinder of 30 and 45 horse-power respectively—are also air-cooled with the usual cast flanges The smaller of these two motors and the Duryea motor both weigh about 200 pounds, or approximately 50 pounds more than the Curtiss 25-30 water-cooled motor with radiator and water The reason for this apparent superiority of the water-cooled motor as regards weight is found in the fact that the Curtiss is a specially constructed aeronautic motor, whereas the air-cooled motors mentioned are simply automobile motors adapted to aeronautic use and not lightened nearly as much as it is possible to lighten them. The same may be said of the Elbridge, which is a marine motor The Waterman, another light marine motor built for canoes and dories, weighs just under 100 pounds complete with flywheel, which can be dispensed with, and develops about 15 horse-power The Harriman is a special 4-cylinder motor of 50 horse-power and weighs 200 pounds It has copper water jackets and aluminium crank-case The bore and stroke are 5 inches. The 8-cylinder V type motor has crank-case and cylinders cast of macadamite The cylinders are lined with cast iron and the pistons also are of a special grade of this metal The bore and stroke are each 4 inches. The output is 50 horse power at 1,200 revolutions per minute The 12-cylinder V-type Buffum motor is constructed similarly to the Easton each row of cylinders being cast in one piece with the upper part of the crank-case and afterward being bored and lined with cast iron This motor is beautifully finished Its weight complete is but 415 pounds, and an output of 100 horse power is claimed for it at 1 800 revolutions per minute

Upon entering the large main hall of Mechanics Building the visitor saw upon his right the Bleriot and Antoinette type monoplanes of the Scientific Aeroplane and Airship Company of New York The former of these machines which is fitted with a 4-cylinder air-cooled 2-cycle motor has lately been experimented with upon ice by Mr Stanley Y Beach and is in a fair way of making a flight in the near future The Antoinette type monoplane was shown with a huge red 9-foot propeller of special design, which has been found to be very efficient A novel type of steering gear having two superimposed wheels was also fitted Opposite these two machines were two Wright type biplanes of Frederick P Schneider The finished one of these two machines had movable flaps upon the rear edges of the wings instead of the warping arrangement used by the Wrights.

Proceeding onward around the hall, the visitor next saw two new monoplanes—one (the Morock) a small demountable Bleriot type machine having wings laced upon steel tubing and the other (the Burlingame) a large monoplane with trussed inclined struts running from the bottom of the wide central frame to the ends of the wings A 50-horse-power Harriman motor, direct-connected to a large and thick propeller, was placed at the front of this monoplane

A biplane that attracted considerable attention was that of Victor Page This had a rectangular central body and extremely thick wings with a deep curvature. A novel revolving cylinder 2-cycle motor (the L. A. W) was pivoted in front, so the propeller mounted upon it could be directed upward or downward

The Hayward and Erickson biplanes were constructed entirely of bamboo In general outline they resembled the Curtiss, as did also the Eisner & Downey and the Reaud machines The Erickson biplane had a Buick automobile motor weighing 240 pounds fitted, the weight of the biplane alone being but 220 pounds

The finest piece of construction on exhibition was the Herring machine, built by the Starling Burgess Company, a well known boat building concern of Marblehead, Mass This machine, in general appearance resembling the Curtiss biplane was mounted upon three round skids no wheels being used The horizontal rudder was worked by the aviator's feet and the vertical rudder by hand A long inclined rod was placed on each side of the seat, to which the aviator can cling Springs were introduced in the guy wires, no turnbuckles being used The poles that carry the front and rear rudders were all hollow A Curtiss motor with a 4 bladed propeller of Mr Herring's design was fitted The machine complete weighed less than 400 pounds The propeller is said to give 280 pounds thrust, which, it is claimed, is ample to start the machine on any ground on its skids The stability device for lateral equilibrium was not exhibited

There were also several gliders on view, and a large number of models of all kinds, most of which were built by boys The exhibition as a whole was a very creditable one It leads one to believe that America will soon catch up to Europe in the aeronautic industry as it did with the automobile

Balloons were also in evidence Among them was the New England Aero Club's balloon in the very middle of the hall, inflated almost to its full capacity This balloon has made 45 ascensions and has traveled 1,251 miles Leo Stevens exhibited the basket of his 30-passenger 160 000 cubic foot balloon A huge hot-air balloon from which a trapeze performer made five parachute drops at Coney Island last summer is also to be seen.

THE COCHIN FOREST RAILWAY

BY EDWARD HARRAN

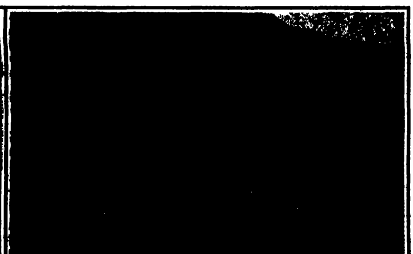
The Cochin Forest Tramway is an interesting little line of tramway on the meter gage in the semi-independent State of Cochin in South India. It runs slightly to the north of the 10th parallel of latitude and to the east of the 75th parallel of longitude, and owes its origin to the fact that the forests of Cochin form one of the most valuable assets of the State, their approximate area being 505 square miles, or nearly one half of its entire extent. Their commercial importance it is stated, was vaguely realized as far back as the beginning of last century, but the earlier attempts to work them were of the usual spasmodic and unsystematic nature which characterized original efforts in forestry throughout the Indian peninsula. In the year 1835, however, a regular forest department, under the control of a European officer, was formed and worked for some sixty years on old fashioned lines. Though the department throughout this period brought in a certain amount of revenue to the fact that a land route, provided means of transportation over it were available, would tap a far richer forest area than a proposed river route alone, while, of course, it would be open all the year round. So it came about that the idea of a tramway in three sections arose, was recommended to and sanctioned by the Durbar. The first section was to cover a distance of 8 miles in the valley, to be followed by a self-acting inclined tramway 5,000 feet long. The second section, 4½ miles long, was to be followed by a slide 7,000 feet long, whence the third section, also 4½ miles long, was to extend to the Kurumali River, from which point timber could be floated to the railway station at Trichur during the monsoonal period and carted to the Chalakudi Station in the dry weather. According to this first propounded scheme, timber from the hitherto unworked Parambikolam Forest was to have been floated by the Parambikolam River to the tramway terminus in the valley. A visit paid by his logs both at the head and floor of the slide proved expensive. To remedy this latter, the conversion of the slide into another self-acting incline was decided upon. To remedy the first, Mr Alwar Chetty recommended, and the Durbar sanctioned, another extension of the tramway, one of 15 miles to Chalakudi, to meet the Shoranut-Cochin Railway at that station, a connection, with the acquiescence of the Madras Railway authorities, being made between the railway and tramway there.

To-day the total length of the line as it stands completed at the time of writing is 49½ miles divided into three sections. The first section extends from mile 1 to 21, the second from mile 22½ to 27, and the third from mile 28 to 49½. The first and second sections are connected by a self-acting wire rope manipulated double way of 1½ miles, while the second and third sections are similarly connected by another incline a mile in length.

The logging locomotive, truck, and caboose.

Stone-and-timber bridge on the line of the Cochin Forest Railway.

Elephants moving logs for shipment.



A train of timber cars. Note the density of the forest growth.

THE COCHIN FOREST RAILWAY

State, there was little or no pretense made of administrating the forests on scientific principles, with the more or less natural result that while the interior of the forest area (from which there were no facilities for transporting the cut timber) remained practically untouched, work being confined to the more accessible portions and those from which transport was easy. It was not until the year 1895 that a move for the better was made when suggestions were made by the Resident, Sir James Thomson, which culminated, early in 1897, in the Madras government placing at the disposal of the Cochin State a British forest officer, Mr Foulkes, for the purpose of inspecting the forests and formulating proposals for their better and more profitable administration. This gentleman's report included the recommendation that the services of a trained and experienced forest officer be obtained, and, acting in accordance with this suggestion, the Cochin Durbar obtained from the Madras government the loan of Mr V Alwar Chetty T F S for a period of seven years. His first care was to inaugurate a period of rest for the overworked area of timber and to set about securing a suitable outlet for the prospective output of the then virgin forests. Surveys disclosed the Highness the Maharaja of Cochin to the Parambikolam and Nelliampatty forests in October, 1903, suggested a revision of this scheme which provided for the extension of the proposed tramway to Parambikolam, an additional 12½ miles, the experience gained during the preceding year or two having shown conclusively that the Parumbikolam River could not be relied upon to carry every year anything like a year's full yield of timber. A survey of this extension was made by Mr Haldwell, a specially engaged engineer, in 1904.

According to the original scheme, the traction of the timber trucks was to have been by manual labor, but when the length of the proposed line amounted to 31 miles, it was recognized that manual labor would prove both too expensive and too laborious, and in September, 1904, locomotive engine traction was finally decided upon. The modifications of the original scheme already alluded to necessitated a full reconsideration of other portions of it, chiefly the proposed combined river and road transport which it was anticipated would not clear the accumulations of timber. Also in practical working it was found that a timber slide, especially in the case of lengthy and heavy logs, was unsatisfactory, and the handling of

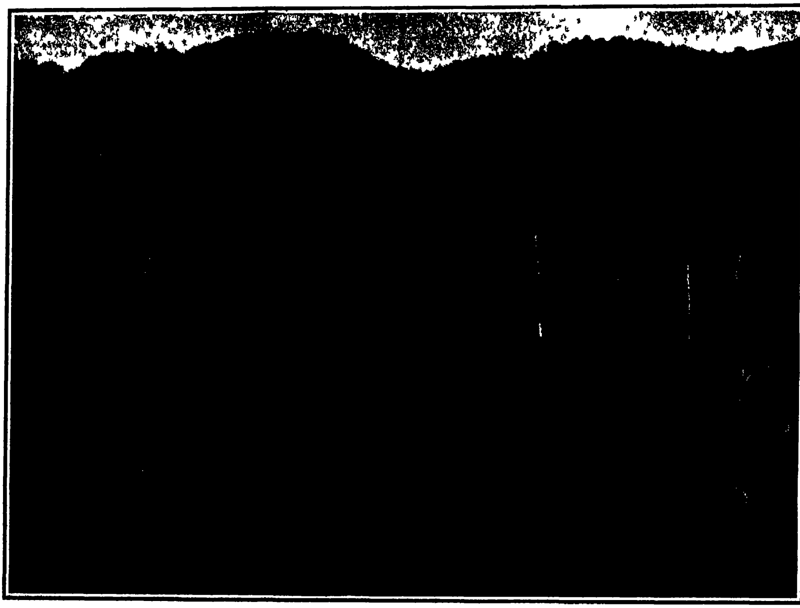
Throughout its whole length the Cochin Forest State Railway is excellently constructed. The gage is 1 meter; the average gradient of the line 1 in 80 and the maximum gradient 1 in 2.5 which gradient occurs on the third of the five inclines which have been embodied in the construction.

The inclined ways are so constructed as to be self-acting, and three of them are situated in series between 21 and 23 miles and the other two between 28½ and 28¾ miles. They are worked by means of wire cables controlled from brake houses by gear brakes independent of each other, and consisting of horizontal wheels round which the cables pass two or three times. The inclines are double railed with suitable cross-over points at the up-hill side of each brake house. The points are so arranged that a descending load, which travels down by force of gravity, requires practically no up-hill shunting, the locomotive places the truck, which on being uncoupled is then ready for the descent. In some cases, however, empty trucks going up have to be hand-shunted after being placed, in order to place them on the side of the upper incline on which the traction rope lies. The ropes are flexible and are of 1¼ inch plow steel wire. The [illegible]

passes over a grooved pulley 4 feet diameter, after which it forms a figure 8 over a loose pulley back again over another 6 foot pulley mounted on the same shaft as the first and thence to the other line

On the vertical shaft on which these two pulleys are, and on which the rope binds are mounted two horizontal drum pulleys each 6 feet diameter 3¼ inches broad with ¼ inch flanges Steel hand brakes 3/16 inch thick and 3 inches broad studded with hard wood brake blocks 6 inches long can be applied to these drums by powerful linked levers controlled by hand wheels and screws, to control the speed of the load descending the incline The grooved pulleys round which the rope binds are filled in with leather sections on end grain to give a good grip The cast iron portion of these wheels is suitably dovetailed out to contain the leather packing

The first second and fourth of the five inclined ways are on curves round which curves the wire ropes are guided by vertical rollers On the straight portion of the inclines the cable is supported by horizontal rollers placed 30 feet apart Illustrations of one of these inclines are here reproduced The rolling stock of the Cochin Forest Railway consists solely of open trucks specially designed for carrying timber with swiveled bolsters and chilled cast-iron wheels



Part of the main line with empty train on a grade

THE COCHIN FOREST RAILWAY

The Art of the Cave-Dweller.

A very noteworthy discovery of caves which has brought to light a number of art objects of the oldest inhabitants is reported by Prof Moser in a late number of Umschau In a depression which has the appearance of a trough of the valley extending from the Karst (Australian) plateau Trieste Nabresina Duino, to the Volnik Mountains are found numerous caves to which leads a gate of rock under the projecting wall of the cliff Their interiors are rooms small or spacious, which were first only places of sojourn for the Karst cave-dwellers who originally nomads later settled down to habitual residence in them That the caves have served a long time as abodes is proven by the fact that in them are found frequent very thick layers of clay interstratified twice, thrice four times, with ashes. In the latter are relics of the household Among the caves visited the Rothgart cave, situated near the viaduct of the Southern Railway, near Nabresina, was subjected to the most persistent examination Prof Moser has yet made In this cave were found four such layers of clay separated by layers of ashes While relics of the new stone-age were found in the first and second layer of ashes in the third and fourth layers were discovered remains of the painter's mussel land snails the bony scales of the swamp-turtle and a mammal fauna such as the otter beaver goat stag and wild bear which manifestly point to the fact that the first cave-dwellers resorted to the fresh water districts for their sustenance while the later cave-dwellers found a much more generous source of nourishment along the coast An important fact is the presence in those oldest layers of frequent tools and to the same layers belong the especially interesting art objects engravings on animal bone described pictorially many of them in the Professor's report. On a polished piece of stag's horn for instance may be seen the rudely made drawing of a human figure that stands between two tree-trunks showing many branches As in the first drawings of children the head is represented by a round depression and hands and feet by slits slightly curved On a second engraved piece of bone a jawbone that was found in the third layer of ashes is pictured with a contour of almost straight lines a wild boar of which the head is almost triangular the tusks being clearly drawn the eyes and ears being faintly indicated the bristles on its back appearing with perfect distinctness and the curl in its tail being rather indistinct That the artist of the cave sought to reproduce the aspect of nature in which he had often seen and slain the wild boar is shown by the high grass in which the animal stands and which is represented by strong incisions. On a thigh bone is easily recognized the head of a sea turtle with eye and deeply cleft mouth the scales and folds of the skin are indicated by easy strokes and above the head is a sufficient hint of a fluttering dragon fly and not far from it are tufts of reed The two last engraved pieces of bone the Professor attributes to an early settlement in the new stone-age while the awkward portrayal of the man may be considered as derived from the old stone-age

While the layers of ashes contained a generous number of finely worked tools of bone and pieces of ornament, the occurrence of relics of man himself is restricted to two skeletons with additions from the Moser cave and very recently the Professor found a well preserved human lower jawbone in the so-called Cave of the Bears Sandstones marked with grooves made by whetting the bone tools on them prove that the caves were also the workshops of the cave-dwellers A high degree of development is shown by the pottery the vessels formed by a free hand are manifold not only in their form and material but also in their decoration one piece being marked with a broad spiral band immediately on either side of which the depressions of the vessels are filled with white color in which are the ears of corn and leaves of palm which ornament the band This piece almost reminds one of the decoration of Mycenaean pottery

Have Fishes Memory?

Studies as to the mental powers of animals have already been made on several occasions but only recently have inquiries been made as to whether fishes have a memory or not Results have shown traces of a memory both in coral zoophytes and other denizens of the deep Experiments have been made with several fishes but the most striking results have been obtained with the gray perch which lives chiefly on a small silvery hued sardine Some of these were taken and colored red and were then put into the tank where the perch was with several other silver-colored sardines Of course the normal ones were at once attacked and eaten but it was not till hungry that the perch made a tentative meal of one of the red colored victims on recognizing the sardine flavor however he promptly demolished the remainder Subsequently the specimens in the tank devoured the sardines irrespective of color thus showing not only traces of a memory but also the power to differentiate color Subsequently sardines colored red and blue were placed in the tank together with the silver ones the same scene was repeated the blue ones not being attacked till the others were eaten and hunger compelled investigation of the new comers After this introduction the perch ate the sardines of all three types without any difficulty Some spines of the sea nettle (actinia) were then fastened to the blue sardines these were at once avoided by the perch who promptly got out of the way of the new comers This showed traces of memory as the results of contact with the sea nettle were clearly shown and recognized

THE NEWLY DISCOVERED GOBLIN SHARK OF JAPAN

BY DR. L. HUSSAKOF

Every now and then the zoological world is startled by the announcement of the discovery in Japanese waters of some very rare or very ancient type of animal So often is this the case that zoologists have come to look upon the deep waters of Japan as a sort of naturalists wonder realm—a preserve in which live all manner of interesting animals some of them of an archaic type long extinct in other parts of the world The expectation of remarkable discoveries in these waters is so strong that I have heard a distinguished American zoologist, who is himself well acquainted with Japanese waters say that he would not be greatly surprised to hear some day that a real Mosasaur or Ichthyosaur had been hooked in the depths of *Kuro Shiwo* or warm Black Current of Japan

Fig 1.—The newly discovered goblin shark (Scapanorhynchus jordani).

It is in these waters that Japanese fishermen occasionally take on their lines a shark whose grotesqueness has won him among natives the name of *Tenguzame* or goblin shark One of these "goblins" came into the hands of President David Starr Jordan of Leland Stanford University a dozen years ago and was at once recognized as an interesting archaic type whose close relatives had long since become extinct President Jordan described it under the name of *Mitsukurina owstoni*—the name being given to honor at the same time the late Prof Kakichi Mitsukuri who for a quarter of a century was the leading light of Japanese zoology and Mr Alan Owston, a natural history dealer of Yokohama, who was instrumental in securing the specimen This name, by the way, does not stand at the present day but must be replaced by *Scapanorhynchus*—a name which had previously been applied to the teeth of the extinct species of this type of shark found in the rocks of the Chalk period, in different parts of the world In accordance with scientific usage therefore, the Japanese shark described by President Jordan must now be known as *Scapanorhynchus owstoni*

It is now to be recorded that a second species of goblin shark has turned up in a most unexpected way It happened thus All of the sharks caught in Japan in the past years and sent to the various museums — about twenty in all—were looked upon as belonging to the same species, *S owstoni* No one had ever thought of comparing several specimens, in fact, these sharks are so rare in museums that comparison is generally quite out of the question It was therefore a pleasure for the writer to have had the opportunity of comparing several specimens in the collections at Columbia University and the American Museum of Natural History and to find among them a new species of the goblin shark This has recently been described in the Bulletin of the American Museum of Natural History as *Scapanorhynchus jordani*—the specific name being given in honor of President Jordan, our greatest authority on the fish of Japan

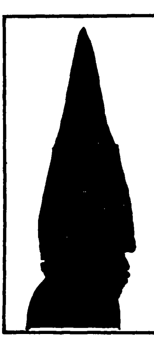


Fig 3.—Under side of head of Jordan's goblin shark, showing mouth and teeth.

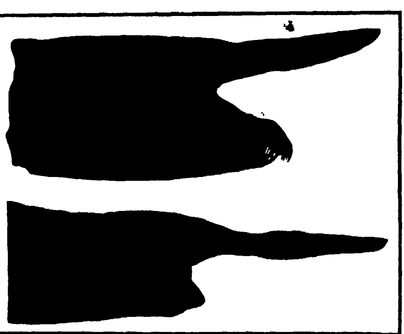


Fig. 2.—Heads of two species of goblin shark The lower one is that of the newly discovered Jordan's goblin shark (Scapanorhynchus jordani).

THE NEWLY DISCOVERED GOBLIN SHARK OF JAPAN.

Now to come to the fish himself As seen in the illustration (Fig 1) the new shark is certainly grotesque, well deserving his sobriquet 'goblin" The largest specimen in this country is one in the National Museum at Washington measuring over eleven feet, and the species probably attains a length of fifteen Fortunately it is not given to frequenting the bathing-beach, but keeps to deeper waters—usually about fifty fathoms As is generally the case with fish from deeper water, this shark is soft and pliable Even after hardening in a preservative for several months, it can be rolled into a ball The most remarkable feature is the curiously elongated "nose" (shown in Fig 2) It is this together with its protruding jaw and small beady eyes, that gives the shark that ugly appearance. The teeth (Fig 3) are sharp and slender, each like the pointed end of an awl They constitute a most effective weapon, which must be fingered with discretion even on the laboratory table As to the peculiar anatomical characters, suffice it to say that in the total make-up it is so different from all other sharks that President Jordan was at first inclined to classify the genus to which it belongs in a special family by itself

As to the differences between the new species and the one already known, we need say only a few words The pictures show the differences at a glance even to the layman in matters ichthyological The new form (lower picture) is distinguished by a much less protruding jaw, by a very much smaller spiracle (the minute accessory gill pore seen at some distance back of the eye), and by the fact that the eye is situated opposite the middle of the jaw instead of back of it These features are quite sufficient, in the opinion of experts, for separating our goblin as a distinct "kind To the general reader they may perhaps be of interest as examples of the degrees of difference which are used by specialists to distinguish species of fish.

Pipe, Cigarette, and Cigar.

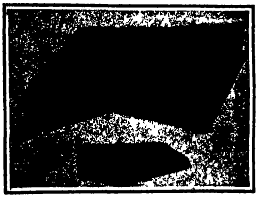
The question as to which of the three forms of smoking, the pipe the cigarette, or the cigar, introduces the greatest proportion of nicotine into the smoker's system has never obtained a completely decisive answer, although it has received considerable discussion from time to time At one time it was freely asserted that the tobacco which contained the highest amount of nicotine necessarily tended to be the most injurious, no matter in what form it was smoked, but we now know that the form of smoking plays an important part There was a theory that not in all three cases was the original nicotine in the tobacco conveyed as such to the mouth, sometimes it was destroyed by effective combustion, while at other times pyridine was responsible for toxic effects. According to this theory which was all on the right track the cigarette was least harmful, because the tobacco along the thin paper wrapper was exposed freely to the air and as a consequence the tobacco was well burnt and all nicotine was destroyed Against this it was held that in such a case one poison disappeared only for another one to be elaborated, and carbon monoxide was found in marked quantity as a poisonous constituent of cigarette smoke. As a matter of fact, carbon monoxide is invariably found in all tobacco smoke, and that circumstance should be sufficient to warn all smokers against inhaling it persistently Theories as to what happens in the combustion of tobacco in the various ways it is smoked next took into account the extent to which condensation products were formed and retained in the tobacco The most effective condenser, of course, is the pipe, and there can be little doubt that owing to the length of the stem a comparatively small proportion of these condensation products reaches the mouth In the cigar, on the contrary, the condensing process has a tendency to travel throughout the cigar, at all events, as the cigar gets shorter the condensed product area gradually reaches the mouth and eventually the products are conveyed there by the heat of the burning end It has been said by connoisseurs that no cigar is worth smoking after one-half of it has been consumed, which seems to be a practical realization of theoretical considerations very suitable for application by millionaires Again, a cigar that has been partially smoked and then allowed to go out is decidedly unpleasant when re-lit, owing doubtless to the spread of condensation products to the mouth end. In the case of the pipe, the burning area is always in the same place, it never comes near the mouth, and therefore the probability is that the condensation products do not reach the mouth in, at any rate, appreciable quantities In the cigarette the condensation products eventually reach the mouth, but there is in this case less chance of condensation products forming since the combustion is unhampered, the tobacco being freely in contact with the air The question of moisture, however, must not be left out in these considerations, for it is obvious that damp tobacco will form condensation products more readily than dry tobacco It is probable, therefore, that a dry cigar or cigarette gives off less poisonous products than a damp one does, but not everyone smokes from choice a new cigar or an old cigarette It is reasonable to conclude that the amount of nicotine reaching the mouth does not necessarily depend on the amount in the tobacco, but on the form in which it is smoked In drawing this conclusion regard must, of course, be had to the quantity of tobacco smoked, but if the conclusion is correct, the pipe would come first as the least harmful form of tobacco smoking, then the cigarette, and lastly the cigar—Lancet.

It has often been remarked that the centers of seismic and volcanic activity move slowly westward In a recent issue of the Physikalische Zeitschrift, H Wehner adopts this belief and endeavors to explain the westward movement by reviving the old hypothesis of a solid nucleus, separated by a thin stratum of liquid from the earth's crust, and rotating slightly less rapidly than the latter According to Wehner's calculations, the nucleus makes a complete revolution, relatively to the surface of the earth, in 952 years. (There is room for a good deal of uncertainty in such calculations.) Wehner supposes, further, that the nucleus is studded with protuberances which are centers of activity and that these protuberances, coming into contact with weak parts of the earth's crust, cause earthquakes and volcanic eruptions. From this theory and the records of earthquake shocks observed by navigators of the Atlantic Ocean during the last sixty years. Wehner concludes that a group of these formidable protuberances has now arrived under the region between 1 deg. N. and 1 deg S. latitude and 27 and 43 deg. W. longitude, and that danger is imminent in that part of the world.

Patent Department

FIREPROOF ARCH.

Pictured in the accompanying engraving is an arch used more particularly in fireproof work, which is of very simple construction It consists of but two tile sections, each provided with an air space usually designated as a "vacuum." The usual I-beams be-



FIREPROOF ARCH

tween which the arch is formed are indicated at *A* and *B* Each arch member comprises a top panel *C*, a bottom panel *D* and a side panel *E* thus giving the member the general shape of a wedge At the point of the wedge one of the members is provided with a tongue *F*, while the other member is formed with a groove adapted to receive this tongue When the two sections are fitted between the I beams they are thus interlocked A weight placed on the interlocked tiles produces an outward spreading thrust against the two I beams *A* and *B* To resist this thrust the I beams are braced by means of cross rods, as indicated by dotted lines in the illustration Our illustration shows part of the upper panel of one of the sections broken away to reveal the reinforcing which, in this case, consists of a netting of heavy iron or steel wire imbedded within the material The lower panel is braced by means of bars *G* imbedded therein which extend up into the tongue *F* They take the end thrust and materially strengthen this portion of the arch The "vacuums" or wedge-shaped air spaces formed between the panels serve to prevent undue travel of heat through the arch in case of fire A building having a large proportion of such arches is therefore to that extent rendered more nearly fireproof than would otherwise be the case The inventor of this arch is Mr Eugene F Fitzpatrick, of 153 Withers Street, Brooklyn, N Y

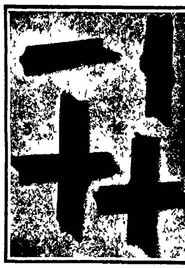
MUFFLER FOR TELEPHONE TRANSMITTERS.

Unless one is using the telephone in a booth or in a quiet room it is impossible for him to exclude all local disturbing noises by stopping the ear that is not applied to the receiver, for the reason that the noises reach him by way of the transmitter of his own instrument In order to eliminate all such disturbing sounds a very simple device has recently been invented which may be applied to any telephone transmitter This device is illustrated in the accompanying engraving It is extremely simple, consisting of two members hinged together, one of them being a ring-shaped plate adapted to be placed over the mouth of the transmitter and provided with ears which are bent back over the outside of the transmitter A wire band is then fitted over the ears, and the latter are bent upward and hooked over the wire Owing to the outwardly flaring form of the transmitter the device is thus firmly made fast. Between the ring-shaped plate and the transmitter is a strip of felt which serves to prevent vibrations that strike the plate from being communicated to the mouthpiece of the transmitter The second member, which is hinged to the plate, is in the form of a flat cover provided on the inside with a lining of felt so that when it is closed down upon the other member it will exclude all sound from the transmitter The hinged cover is provided with a finger piece, by which it may be opened whenever one desires to use the transmitter but at all other times it should be closed to exclude local noises The inventor of this simple attachment for telephone transmitters is William D Plumb, 2022 Lexington Avenue, New York city

MUFFLER FOR TELEPHONE TRANSMITTERS.

WROUGHT-STEEL SASHES.

In this the sanitary age we have come to recognize the importance of daylight in our work rooms as well as in our homes The germicidal effect of sun light is well recognized Add to this the fact that artificial light costs money, while sunlight is free, and nothing further need be said to demonstrate the superiority of the daylight shop, both from the sanitary and the economical point of view Recently a new type of window sash has been devised for industrial buildings, which, it is claimed, by doing away with the cumbersome frames and heavy mullions makes it possible to deliver 35 per cent more light through a given opening than heretofore The sash is of very simple construction, and yet is much stronger than the common wooden sash It is better able to withstand the pressure of the wind, and furnishes no fuel to a fire It is made of steel bars rolled to the cross section shown in the accompanying engraving The method of joining these bars is very ingenious and decidedly unique A small cross slot is made in the

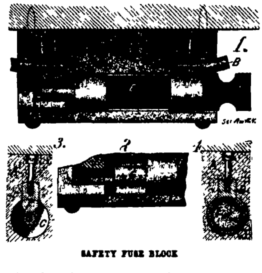


NOVEL JOINT FOR WROUGHT-STEEL SASHES.

vertical bar (Fig. 2) of the sash just large enough to admit the flange of the horizontal bar The molded part of the vertical bar is then pressed out so as to fold closely around the molded portion of the horizontal bar, as shown in Fig 3 In the latter bar a small notch is cut as indicated in Fig 1 to act as a lock It will be observed that the amount of metal removed in making this joint is infinitesimal The bars run without break from top to bottom of the window as well as from side to side, making a particularly strong framework, and this permits of using a much lighter section than is possible with a miter joint construction, so that a great saving is effected in the weight of the material used and consequently in the ultimate cost of the sash Furthermore, the unusual type of joint makes a break in the monotony of the window sash which is pleasing to the eye A patent on this type of sash has been secured by the Detroit Steel Products Company of Detroit, Mich.

SAFETY FUSE BLOCK.

Heretofore when fuses such as the screw plug, ordinary cartridge, or the open wire type, have been used, it has been customary in making temporary installations, requiring a larger capacity than supplied by the block used in the original installation to remove the original fuse, and to substitute therefor one of larger and in many instances of a dangerously large carrying capacity This has resulted in permitting a load to be introduced on the wires which has taxed and in some cases broken down the insulation by heat, resulting often in producing a dangerous fire To obviate such possibilities the fuse block illustrated in the accompanying engraving has been devised It is so arranged as to prevent the introduction between the terminals of a line of a fuse having a larger carrying capacity than is designed for the line The block *A* as shown in Fig. 1 is provided with a cylindrical compartment that opens at one end into a recess *B* and at the other end communicates through a partition *I* with a recess *C*. Each recess is fitted with a lug adapted to receive the terminal wires of the line The lugs are engaged by screws that pass through the blocks and serve as binding posts to hold the line wires The lug *D* in the recess *B* is provided with spring clips of accurate form adapted to grasp the body of the fuse *E* The lug *F* in the opposite recess is also provided with

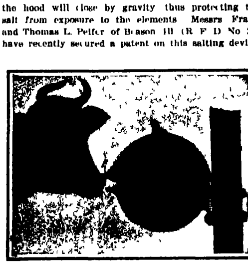


SAFETY FUSE BLOCK

spring clips adapted to engage a boss *G* which projects from the end of the fuse The fuse is provided with the usual metallic contact bands and one end is furnished with a handle *H* All of the fuses adapted to be used with a block of a certain ampere carrying capacity are fitted with bosses of the same size A fuse of larger carrying capacity however, would have a boss of larger diameter If one should attempt to insert a fuse of larger carrying capacity into the block the boss would fail to pass through the partition *I* and enter the clip *F* as shown in Fig 2 and no contact would be made with the line terminals The inventors of this electrical fuse block are Messrs. A A. Moffitt and G E Andrews, of 40 Bridgham Street, Providence R I

AUTOMATIC STOCK SALTING DEVICE.

Cattle when housed or running free in a field need a limited supply of salt to maintain them in good condition If the salt is placed in troughs mixed with feed some of the animals will prevent others from getting a proper amount of the salt The accompanying engraving illustrates a device which affords free access to the stock for obtaining the requisite amount of salt and at the same time protects the salt from the elements and prevents waste It consists of a cup-shaped receptacle which is hemispherical, as indicated at *A* in the illustration A cover piece *B* is secured to the receptacle *A* by means of screws which are threaded into lugs *C* formed on the member *B* The cover piece is also hemispherical in shape, but is cut away at the forward side to admit the muzzle of the animal A hood *D* is hinged to the cover *B* and serves normally to close the opening in the latter At the forward side of the hood is a lip *E* which projects forward and is curved upward The receptacle *A* is provided with a similar lip *F*, which however is curved downward thus leaving an opening which will expose the salt and attract the stock In use a sufficient number of the salt holders are placed in the corral or the field where the stock range to enable the cattle to obtain the salt The animal raises the hood by shoving his muzzle beneath the lip *E* and rocking the hood back until it engages a lug *G* When the animal withdraws his muzzle for the salt holder the hood will close by gravity thus protecting the salt from exposure to the elements Messrs Frank and Thomas L. Pelfer of Beason Ill (R F D No 2) have recently secured a patent on this salting device



AUTOMATIC STOCK-SALTING DEVICE.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

BELT ATTACHMENT.—B E. Nye, Groton N Y The object in this case is to provide an attachment for holding the buckle end of the belt from slipping on the trousers Use is made of a hook adapted to engage the fastening device for connecting the front flaps of the trousers with each other the shank of the hook terminating in a pin adapted to be fastened to the belt

Of Interest to Farmers.

GATE J W Matthews, Brady, Tex This invention is an improvement on the former patent granted to Mr Matthews and provides a durable farm gate which can be opened and shut from points remote from the gate itself It is positive in operation and requires the expenditure of little effort to close or open it the gate being operable, for example, by the occupant of a vehicle

MILKING MACHINE —B J Bigelow La Crosse Wis An object of this inventor is to provide a machine which is capable of milking cows or other animals quickly and with little effort The device will effect the operation in a sanitary manner thereby preventing the spread of disease which is likely to result from the unsanitary methods of the ordinary process

Of General Interest.

ARTIFICIAL FUEL AND PROCESS FOR MAKING THE SAME C F Bonhack, New York N Y This invention relates to artificial fuel and particularly to fuels of this kind which are formed from small sizes of coal or from coal dust which is incorporated with a binder so as to form lumps or briquets which can be conveniently burned upon a grate

PAINT AND VARNISH REMOVER M Daxe New York, N Y The improvement has reference to means for removing paint and varnish from woodwork and the like and the object of the inventor is to produce a preparation which will operate effectively to soften the varnish and paint so as to facilitate its removal as suggested

Prime Movers and Their Accessories.

STARTING AND STOPPING DEVICE FOR GAS AND OTHER ENGINES J W Ellis Denison, Tex This device for gas and other engines is for use in connection with a water supply system to provide a constant supply of water, and designed to dispense with attention except at long intervals When the water falls below the predetermined level a switch is operated to close the main circuit which includes the storage battery and the motor and as the current strengthens the rheostat is gradually cut out The motor drives the engine and when the latter attains its full speed the clutch is operated to connect it with the pump and the motor is converted into a generator, recharging the storage battery

Designs.

DESIGN FOR A PLATE OR SIMILAR ARTICLE A Kohn Weiden, Bavaria Germany The plate is round The outer edge and bottom of the rim are circled by a narrow band comprising leaves and berries of very small size producing a refined ornamental effect

Note —Copies of any of these patents will be furnished by Munn & Co for ten cents each Please state the name of the patentee, title of the invention and date of this paper

NEW BOOKS, ETC

The Fourth Dimension Simply Explained A collection of popular essays and editorial notes by Henry P Manning Ph D Associate Professor of Mathematics in Brown University Illustrated New York Munn & Co, Inc, 1910 12mo, 251 pp Price, $1 50 net.

When the Scientific American's Prize Fourth Dimension Competition closed the judges were astonished at the number and variety of the essays which were received. For the most part the authors showed an excellent grasp of a very abstruse subject Some of the essays were of such merit that to preserve them in permanent form seemed advisable Accordingly Professor Henry P Manning who was one of the judges in the competition, was entrusted with the task of selecting about twenty of the best essays supplying them with critical notes and furnishing an introduction The present volume is the outcome of his labors. The volume contains not only the essays which he selected but also the essay of Lieut Colonel Graham Denby Fitch which received the Five Hundred Dollar Prize, and the three honorably mentioned essays which were published in the Scientific American together with his.

Professor Manning in his introduction dispels the notion that the fourth dimension is a mathematical delusion with which no sane man ought to occupy himself He points out that the mathematician is not concerned with the existence or non-existence of the fourth dimension He is simply concerned in the construction of a geometry in which there is no contradiction nor anything that is philosophically impossible

The essays in this book are all non mathematical or popular in their treatment. They are therefore necessarily limited in their form of presentation By a comparison of the lower dimensional geometries the essayists derive analogies for the geometry of four dimensions, analogies so complete that the subject can be very fully explained in a non mathematical way The analogies are a guide even to the mathematician, but the fourth dimensional geometry does not depend upon these analogies. As a system of theorems and proofs it is built up from its axioms by a process of logical reasoning just as the lower geometries are built up.

Each of the twenty two essays in this book is 2 500 words in length The reading of one essay does not involve the reading of the entire work, yet the entire book gives a very good view of what the layman wishes to know about the fourth dimension. No abstract mathematics can be found anywhere in the volume The essayists have endeavored to explain the fourth dimension both by imagining the effect of transporting an ordinary third dimensional human being into fourth dimensional space, and also by explaining a third-dimensional man's possibilities in one of two-dimensional space. The result is a collection of essays which are as interesting as any fairy tale

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending February 15, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents]

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Adding machine J G Vincent 949 419
Advertising device Perew & Dischinger 949 287
Air and gas engine B M Aslakson 949 189
Air compressor rotary F Peck 949 714
Air current governor N P Smith 949 000
Alarm See Burglar alarm
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Boring or milling cutters, manufacturing, J G Matthews 949,377
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Bottle capping machine, E. Dray 949,417
Bottle capping machines, bottle rest or guide for, Nottberg & Lehmann 949,712
Bottle caps, tool for applying Abrams & Taliaferro 949,609
Bottle non refillable, H. Corrigan 949,220
Box clamp H Burch 949,619
Box lid or cover, shoe polish, J W Davis 949,148
Bracelet H. B Holbrook 949,328
Braiding machine A Orthmann 949 245
Brake J Burck 949 631
Brewing process, R. Kubessa 949 581
Brick drier E. H Callaway 948,965
Brick machine L. M Pratt 949 042
Broom with detachable handle P J Karst 949,577
Brush folding tooth, F E. Kress 949,540
Brush shaving, H H Belknap 949,642
Brush tooth, B Ludington 949,587
Building frames etc, coupling for members for D J Daly 949,394
Building purposes, machine for producing slabs for J C Snelling 949 505
Bullet C Ross 949,028
Bundle carrier, C N, Sharp 949,334
Burglar alarm for vaults safes, or the like, electric E. Seragnoli 949 451
Burner See gas burner
Button, J Tams 949 310
Buttonhole machine, G W Nelson 949 401
Cake trimmer J H. Hempen 949 149
Can body forming machine, J E. Abrams 949 722
Can cleaning apparatus C H Hood 949 121
Can beading machine, E. J Morris 949,083
Can righting device C F Colbert 949 647
Cans or boxes, apparatus for the manufacture of sheet metal A W Stoker 949 406
Canning apparatus A McKnight 949 710
Candy cutting machine E R. Koott 949 434
Cap solder hemmed E. M Lang, Jr 949 582
Car brake J H Hand 949 471
Car door brackets freight, H Kappele 949 464
Car door dump E Otis 949 404
Car fender A C Seeger 949,200
Car grain door freight P S Batsiaff 949 659
Car hand J C Dunlop 949,418
Car heating systems thermostatic controller for J F McElroy 949 285
Car lift F C Greene 949 228
Car pay as you enter, H Rowntree 949 717
Car pay within H Rowntree 949 131
Car replacer W S. Coppers 949 315
Car step register operating, F Langhorst 949 290
Cars wardrobe hanger for sleeping J A Halderman 949 750
Carbonizing or case hardening low carbon steel, H Rodman 949 447
Carbureting machine, automatic J F Becker 949 140
Carding machine J J Henderson 949,271
Carnation support H J Loster 949 239
Carpet beater, H L. Schuler 949,082
Carpet sweeper brush cleaning device Armor & Collier 949 694
Case hardening material H Rodman 949,446
Case hardening or cementing H Rodman 949 444
Case hardening or cementing material H Rodman 949 448 949 540
Cement or other liquids to stock machine for applying liquid A R. Johnson 949 018
Cement post M C Nolte 949,564
Cementation by dry packing H Rodman 949 443
Cementation compounds, retreating H Rodman 949 441
Cementation or case hardening material H Rodman 949 440
Cementing low carbon iron H Rodman 949,445
Cementing material and making the same, H Rodman 949 442
Cementing or joining materials or articles, composition for J T Norman 949,493
Centrifugal separating machine, H M Goodman 949 320
Centrifugal separator H M Goodman 949 227
Centrifugal separator W R Macklind 949 458
Centrifugal separator, W P Shepherd 949 603
Chair head rest Bausch & Schelb 949 119
Check book J Tschudi 949 099
Chemicals package for C F Jenkins 949 706
Chest See tool chest
Chuck drill J W Rhyne 949 430
Cigar moistener J F Herbrick 949 420
Cigar moistener, J C Fetherow 949 606
Cigarette machine and case F W Downing 949 067
Circuit closer automatic T W McKenzie 949 593
Circuit wire covering pipes, connecting device for T E Murray 949,243
Cistern form C B Elliott 949 172
Clamp stirrup, Metzger & Moore 949,241
Clamping attachment J Bell 949,332
Clay ballast device for use in producing burnt G M Bennett 949 741
Clock E A Hummel 949 705
Clock synchronizing apparatus electric E A Hummel 949 122
Clothes line hanger safety F J Eckhardt 949 700
Clothes rack P L. Fowler 949 090
Clutch mechanism F J Wilson 949 559
Coin controlled mechanism single action J W Patterson 949 438
Coke ovens apparatus for watering coke in Affelder & Gorton 949 390
Collar shirt N Kauffmann 949 237
Collar stuffing machine horse Collett & Rennie 949 293
Combing machine, Fringe, Pennington & Andrews 949,068
Combustion regulating apparatus, G W Parker 949,596
Commutator for dynamo-electric machines, M Walker 949 103
Composite system O T Lademan 949 188
Composition of matter F A Crandall 949 061
Concrete construction reinforced, P W Cook 949,262
Condenser water heater and oil separator, steam J E. Caps 949 217
Conduit outlet H A Gilbert 949,028
Container and grating device combined C Winiack 949 385
Converter, variable ratio rotary J L. Woodbridge 949 281
Cooking utensil P Steger 949 453
Coolers, coil protector for A C Canida 949,216
Cooling and drying materials apparatus for W G Schroder 949,718
Copper producing electrolytic A S. Ramage 949 008
Corn shocker R. Schell 949,718
Corner clamp, A H. Stetson 949,096
Corner fastener, G Bennett 949 149
Cornet mouthpiece, H L. Lenherr 949,021
Cotton cleaner T W Felton 949,637
Coupling See drill coupling
Crate metal shipping J A Mayer Sr 949,191
Crib attachment, A. L. Almgren 949,390
Cross head, B. M Aslakson 949,137
Cultivator P Olsson 949,244
Cultivator, R. W Simpson 949,382
Cultivator attachment, H Christoffersen 949 218
Cultivator tooth, F R. & J S. Bradley 949 606
Culvert, metal, C. H Freeman 949 566
Currency cutting or shearing machine, J J Colley 949 462
Current motor, J. W Myers 949 747
Cutter head, M. H Lyons 949 128
Cutting mill G A. & C T Eagle 949,116
Decanting device, W P Kinsella 949 019
Dental castings, apparatus for making Carlberg & Ryan 949,391
Dental handpiece guard, C Hirschhorn 949 272
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Depression position finder device for correcting for the earth's curvature and atmospheric refraction on s. Whistler & Hearn 949,488
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Die head, adjustable, J. A Katzenmeyer 949 278
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Display rack, merchandise, E. D. Diege [illegible]
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Door hanger, barn, W F. Jacobs [illegible]
Door lock, L. F. Roberts [illegible]
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Dough or analogous material, machine for mixing and kneading, O. T. Bagg, Jr. 949,818
Dowel pin, S. C. O. Berg 949,611
Draft appliance, T. J. Dudley [illegible]
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Drill coupling, rotary, L. Mason 949,309
Drill mounting, U. C. Hansen 949,437
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Duplicating machine, Lerner & Bean 949,496
Dust collector, F C. Hemmer [illegible]
Dye for chromed wool and making same, Aso. H. Oster 949,622
Dye, making a thioindigo, R. Munch [illegible]
Earthenware, machine for brushing W Polk 949,281
Electric cut out, T R. Murray 949,233
Electric distribution system, A W Gray 949,534
Electric furnace, C A. Weeks 949,511
Electric generator and engine combined magneto, F I and R. P Remy 949,654
Electric machine, dynamo, E. C Wright 949,168
Electric machine, dynamo, H. G. Reist [illegible]
Electric machine, dynamo, E. F W Alexanderson 949,345
Electric machines, brush holder for dynamo, W T Hensley 949,073
Electric switch, C J Klein 949,123
Electric switch, L. P Coulter [illegible]
Electrical controller, F L. Sessions 949,333
Electrical switch, J D Hilliard 949,063
Elevator, P N Davey 949,260
Elevator apparatus, alternating current, D Larson 949,740
Elevator brake, W R. Elliott 949 528
Elevator safety device, H J Hoy 949,274
End gate, wagon, G W Edson 949,508
Engine See air and gas engine
Engine cylinders, attachment plug for, N M. Hopkins 949,704
Engine driven by inner combustion motor, A. Klose 949 580
Engine indicating apparatus, F Purdy 949,129
Engines safety apparatus for hoisting D. F Lepley 949 022 949 023
Engines, timer for internal combustion, L. C. Chowning [illegible]
Envelope safety M A Evans 949 661
Excavator L. A Deay 949 554
Exhibitor H M Gibson 949 569
Expanding machine, T H Kane 949 488
Extension table J J Gruender 949 119
Fan, centrifugal I Kestner 949 150
Faucet mixing Ross & Tollinger 949 044
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Fence post B Wise 949,208
Fence post mold or form A L. Roop 949 097
Ferrules making cant hook S. Esterline 949,819
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Firearm locking device, R. Frommer 949 407
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Flue cleaner S. S. Poole 949,495
Flue joint and its attachment to flue sheets C R. Coleman 949,631
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Fluid pressure regulating device, G S. Gaslee 949 180
Folding gate A Bataille 949,759
Food cattle E. S Davis Jr 949 416
Food product and making the same, B N. Summers 949 039
Foot guard R D Culter 949,649
Fork bundle hay O Reynolds 949,099
Fountain, C. A Dunlap 949 267
Frame See display frame
Frequency generator variable G Faccioli 949,520
Friction let off J Fuller 949 268
Fruit picker's bag E J Mason 949 024
Fuel, machine for forming artificial pressed, Foreman & Thornton 949 176
Fuel treating A G Maul 949,826
Funnel and measure, combined, W R Hickox 949,074
Furnace charging apparatus blast B H Rogers 949 408
Furnace construction, N D Oliphant 949,409
Furnace grate bar R. L. Thomas 949 669
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Furniture construction J Abel 949,168
Fuse for electric circuits, C J Dorff 949 296
Fuse plug electric J H Hanson 949 630
Game apparatus, W F Schnelle 949 609
Game apparatus, exercising, Taylor & Bartlett 949,885
Game board A Schmittner 949,667
Garment fastener, H I Elson 949 084
Garment infants W B Tyrrell 949 164
Gas burner J Davis 949,676
Gas burner P J Aitsberger 949,669
Gas burner self igniting H Ruppert 949,509
Gas lights manufacture of incandescent bodies for M von Unruh 949,019
Gas retort furnace R. M Brooke 949 674
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Gasket for pipe joints, F J Randall 949 608
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Grader, road, J P Lutes 949,589
Grain spout sections, connector for J Redmond 949,490
Grate J W Fowler 949,065
Grate bar leaf renewable T N. Johnson 949 079
Grip device, intermittent, Pond & Wagner 949,804
Gun, grease W S. Stapley [illegible]
Hair drying device, R. Parker 949,719
Hair waving P E. Herrmann 949,278
Hand rail support porch T Hulett 949,075
Harvester corn, J A Stone [illegible]
Harvester, cotton, E. Childs [illegible]
Hat size reducing device R. H. & H D Curtis [illegible]
Headlight, H. L. Schuler [illegible]
Heat regulator, steam, J F McElroy [illegible]
Heater, T G Palmer 949,042
Heater, H K. Moore [illegible]
High chair go cart, G R. Francis 949,421
High-potential switch, F O. Hartman [illegible]
Hinge, O R. Milke [illegible]
Hinge track door, I Feigenbaum [illegible]
Hitching device stock, R. Klemetson [illegible]
Hoisting apparatus, H. Osterhaus [illegible]
Hoof pad, yielding, A. B. and W P Haley back 949,306
Hook See check hook.
Hook O Atkins 949,014
Hooper, R. M. Ramley [illegible]
Hose coupling W J Watt [illegible]
Hose nozzle support fire, J J Meskill [illegible]
Hydrocarbon burner D. W Young, Jr. [illegible]
Hydrocarbon burner, A. R. Bruner [illegible]
Ice cream freezer, E. I Young [illegible]
Ice pick F W Geisenhainer [illegible]
Ice pick, R. R. Spalke [illegible]
Ignition device, B. M. Aslakson [illegible]
Incubator, J H Klinke [illegible]
Inking roller, R. W Munk [illegible]
Insulation system, L. Steinberger [illegible]
Insulator, electric H. W Elson [illegible]
Insulator for high potential circuits, E. R. Kalman [illegible]
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Iron refining furnace, Hawkins & Kay ...	949,475
Ironing board, O. E. Gall	949,646
Ironing board, electromagnetic, E. S. Clayton	949,361
Jack locking device Eaton & Pride	949,460
Junction box W J Graham	949,426
Keg, powder, L. B. Eaton	949,626
Knife edge bearing, A Sonander	949,094
Knit fabrics, machine for knitting, G Keyser	949,289
Knitting machines, looping device for, J W Latcher	949,876
Knot tying machine, J. O. Anderson	949 406
Labeling machine, bottle, F N Young 949 567,	949,068
Ladder extension, H Epstein	949 529
Ladder rungs and the like support and brace for, F C. Myer	949,194
Ladder, step, W J Blundell	949 614
Lamp acetylene gas generating, J Blesser	949 349
Lamp, arc, J T H Dempster	949 353
Lamp circuit, vapor electric, P H Thomas	949 335
Lamp cleaner, electric E. E. Edgerton	949 419
Lamp, electric arc J C Lincoln 949 061	949 151
Lamp, inverted incandescent gas, G Baup	949,547
Lamp, metallic filament incandescent, W Majert	949 152
Lamp, miner's Davis & Monteith	949,318
Lamp socket cluster C D Gervin	949,535
Lamp socket, electric R. B Benjamin	949 209
Lamp socket incandescent W H Perkins	949 363
Lamp socket, incandescent electric D E Bown	949 517
Lanterns, match holder attachment for, W C. Braun	949,890
Last support and last unlocking device combined G G Schelter	949 160
Latch, door C D Smith	949 405
Latch for door hangers, M Cowey	949,221
Lawn sprinkler G H. Choate	949 520
Ledger, self indexing A. J Achter	949 514
Leg spreader C Freund	949 118
Lens holder, J M Chappel	949 412
Lifter See pan-lifter	
Lifting jack, multiple, A H Scholle	949 331
Lightning arrester, G W Clark	949 565
Lightning arrester, pole line A R. Rheinberger	949 130
Line check W B Fowler	949 177
Liquid into vessels through a closed chamber by an adjustable nozzle, means for introducing J A Hicks	949 479
Lock, E. N Badger	949 409
Lock, C A Berry	949 613
Locomotive ash pan H A Hoke	949 017
Locomotive ash pit O Spaeth	949 102
Locomotive electric E. F W Alexanderson	949 347
Loom, J E Goodwin	949 629
Loom dobby Kuttruff & Frefel	949 238
Loom rack adjustment R. Kendrick	949 579
Loom shuttle box motion A A Gordon, Jr	949,355
Loom stop motion P R. Provost	949 365
Looms, weft carrier for needle J P Humphries	949 706
Lumber register, R. H Mellows	949 127
Magnet for dynamo electric machines field E Mattman	949 082
Mail box support H J Hanson	949 231
Mail marking machine F C Illfeld	949 375
Mantle protector and holder, O E. Hulse	948 995
Manure spreader frame F Schaal	949,601
Manure spreaders, drill attachment for, C H Ellis	949 173
Massage apparatus M A Haines	949 290
Massage apparatus J Sabatino	949 550
Match box holder H C Kirk Jr	949 185
Match case B Epstein	949 528
Match receptacle cigar cutting J P Crosthwait	949 521
Matchsafe J L Dunning	949 223
Measurement gage outside or inside C. E. Johansson	949 276
Measuring device foot J H Waite	949,280
Meat compound preparing a preserved, H. Toth	949 836
Meat press, E M Johnson	949 234
Meat slicer and cutter combined, J Winkelmeyer	949,344
Medical implement M J Rogers	949,882
Metals from solutions, electrolytic apparatus for recovering W A Hendryx	949 016
Meter testing device H P Westcott	949 640
Milk and cream purifying apparatus, J H Curran	949 206
Mill See Cutting mill	
Minerals, separation of combined, A S Ramage	949 002
Miter box W Turner	949,100
Mixing machine, P A Koehring	948,090
Mixing machine A J Cropp	949 098
Mold, J A Rathbone	949 496
Mold filling machine J Anderson	949 743
Molding apparatus, J A. Rathbone	949 407
Mop, J D Keeney	949 079
Mosquito bar support, A F Chastant	949,620
Motor control, single-phase, E. F W Alexanderson	949 346
Motor control system E W Stull	949,007
Motor control system, electric, W Cooper	949,114
Motors and receptacles, support for, J O Neuschwander	949,197
Mount trimming machine, C H. Cadieu	949 110
Musical instruments, valve for pneumatic G S Williams	949 250
Muzzle and calf weaner, W H Lyman	949 730
Nail or spike puller G W Trogner	949 537
Necktie C Reynolds	949 398
Nest for poultry recording G A L. Angles	949 610
Nozzle J G Martin	949 189
Nursing attachment, H B. Cunningham	949 414
Nut lock, H Betz	949 412
Nut lock Davidson & Mauldin	949 024
Nut lock, C D Loehr	949 741
Oil burner P H Herriff	949 073
Oil burner Cowan & Felten	949 648
Oil burner, crude F D Stalford	949 141
Oil gun Mollaert & Laurent	949 103
Open hearth furnace S E. Meyers	949 192
Ore sampling apparatus, A J McLone	949 284
Ore separator, G W Kunkel	949 709
Ores, nodulizing fine J Weatherby Jr	949 387
Oscillating motor G Hager	949 373
Pan, P C Howland	948 994
Pan and plate lifter G C Degner	949 680
Pan lifter D. O & A. R Henry	949 573
Paper bag machine, W C Fuller 949 468	949 469
Paper bottle C F Jenkins	949 036
Partitions, sanitary base for G C Mason	949 380
Paste tube, F Muller	949 545
Pen fountain W E. Geyer	949,430
Pencil holder J W Mills	949 091
Pencil sharpener D. L. McBride	949 085
Photographic printing frame D J Lindsay	949 125
Pianos, action for pneumatic player, Berglund & Webb	949 612
Piling metal J J Harold	949 473
Pin. See Dowel pin	
Pipe cleaner, G N Cragin	949,622
Pipe coupling, F C Pablow	949 329
Pipe coupling train, H W Thomas	949 046
Pipe hanger E C Hunter	949,576
Pipe threading tools, work holder for B Borden	949 031
Pipe wrench, J F Wright	949 107
Pipe wrench, E A Whetzel	949 357
Piston ring, W A. Reinhardt	949 600
Plane guide, W T Whiteway	949 691
Plant stand, adjustable J M Hamm	949 535
Planter seeding attachment J L Baldwin	949 254
Plastic material mold, G A Harter	949 571
Plate or dish child's J C Matthews	949 025
Plow, J H Nicholes	949 492
Plow, J G Redmond	949 686
Plow, J R. Rossetter	949 098
Plow harrow attachment A L. Lare	949 039
Plowshare, G J Buckley	949 617
Pneumatic cleaner, A. C Buell	949,370
Pocket guard, A. J Bulish	949 673
Polish device, R. M Schauman	949 045
Powder and other substances, instrument for administering, L. J F Nicolai	949 302
Power transmission device G A. Cutter	949,266
Pressure gage, differential, B. J P Roberts	949 598
Primary battery, W C. Banks	949,256
Printing machine sheet feeding device, G Kiehn, re-issue	13,063

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Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

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WE ARE WELL EQUIPPED to manuf. some patented article, electrical and woodworking, on royalty or other satisfactory basis. Will entertain exploiting. Electrical, Box 773, N. Y.

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FOR SALE.—U. S. patent rights to highest bonafide bidder April 2, 1910, telephone muffler. Telephone booths no longer necessary. See descriptive notice elsewhere in this issue. W. D. Plumb, 2022 Lexington Ave., N. Y.

Inquiry No. 9014.—For manufacturers of machinery supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

FOR SALE

FOR SALE.—Engine lathe, swings 9½ in., takes 25 in. between centers. Complete with full set change gears to cut all size threads 8 to 40 in. Price only $40.00. Address L. F. Grammes & Sons, Allentown, Pa.

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MINING PARTNERS WANTED. I want to form a mining and prospecting company for mining gravel deposit and quartz in Plumas Co. I can give the best of references. For further information address Robert Belden Pulga, Butte Co., Cal.

Inquiry No. 9023.—Wanted, to buy silk machines from re-reeling, twisting, doubling, to the final process of making it into clothes.

LISTS OF MANUFACTURERS

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

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A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9036.—Wanted, the address of the manufacturers of "Cycle Ball Bearing Suspenders."

Inquiry No. 9038.—Wanted the address of the Chipman Electric Purifying Co.

Inquiry No. 9042.—Wanted the address of Farney Safety Razor Co.

Inquiry No. 9052.—Wanted, address of firms who install plants to manufacture nitrogen.

Inquiry No. 9055.—Wanted address of parties interested in Log Cleaning Machines.

Inquiry No. 9057.—For manufacturers of glass and china balls, used as fixtures or ornaments on lightning rod equipment, also weather vanes for same purpose.

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Inquiry No. 9068.—Wanted to buy machinery for manufacturing chewing gum, such as rolling, cutting or wrapping machinery.

Inquiry No. 9069.—For the address of firms making chain cloth, something like ladies' purses are made of.

Inquiry No. 9070.—Wanted, manufacturers of metal castings for art lamp shades.

Inquiry No. 9071.—Wanted, the address of parties making moulds for large concrete vases for flower pots.

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Inquiry No. 9073.—Wanted, machinery to manufacture coconut oil; also the crude material.

Inquiry No. 9074.—Wanted to buy old model locomotives or steamboats, such as were exhibited with nickel-in-the-slot attachments in ferry houses, etc.

Inquiry No. 9075.—Wanted to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

Inquiry No. 9076.—Wanted the address of parties in Canada who could make a safety razor.

Inquiry No. 9077.—Wanted, the address of manufacturers that make small articles of wood, such as checker boards, etc.

Inquiry No. 9078.—Wanted, the address of manufacturers of sewer pipe made of fiber and asphaltum, suitable for laboratory use.

Inquiry No. 9079.—Wanted, parties to make a special steel plate rolled for "angle bars," in large quantities.

Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

Inquiry No. 9081.—Wanted, manufacturers of a mixing machine to mix powdered and fluid ingredients to a thin dough; also molds to put such dough in to dry; the size to be about 3½ inches long, 2¼ inches wide and 1¼ inches high, making the form of a cake like sapolio.

Inquiry No. 9082.—Wanted the address of manufacturers of the bead fringe used on art shades for electric lamps, etc.

Inquiry No. 9083.—Wanted, the address of firms manufacturing small beer brewing plants, from 15 to 100 gallons a day.

Inquiry No. 9084.—Wanted, the address of manufacturers of Irwin portable bath tubs.

Inquiry No. 9085.—Wanted to buy longitudinal hollow perforated tubing.

Inquiry No. 9086.—Wanted, to buy a pine wood peeler.

Inquiry No. 9087.—Wanted a machine for hardening hack saw blades; also a machine for setting same when they have been toothed.

Inquiry No. 9088.—Wanted, the address of manufacturers of family sized peanut pulverizers for making peanut butter.

Inquiry No. 9089.—Wanted, the address of manufacturers of galvanized steel perforated hollow tubing.

Pulley and speed gear, expansible, R. H. Rosewarne ... 949,686
Pulping liquors, treating spent alkaline, W. J. Hough ... 949,394
Pump, O. W. Johnson ... 949,377
Pump, J. B. Garber ... 949,428
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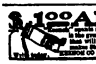

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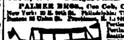

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A TRIBUTE TO AMERICAN SHIPBUILDING.

Although the general public has apparently failed to appreciate the significance of the recent winning of a $22,000,000 order for battleships by an American shipbuilding firm in competition with the leading yards of Great Britain, France, Germany, and Italy, the importance of this matter is fully appreciated abroad.

The facts are as follows: About one year ago the Argentine government asked for proposals for two first-class battleships, and it requested four American firms and all the leading foreign shipbuilders to put in bids on the contract. The plans submitted were not accepted. The Argentine Commission then prepared its own specifications and asked bids from a selected number of these contractors. On the receipt of the second lot of bids it again narrowed the competition down to one American firm, the Fore River Company, two English firms, Vickers Sons & Maxim and the Armstrongs, and one company each from Germany, France, and Italy. As a result of this last competition the award was given to the Fore River Company on designs and price submitted by President Francis T. Bowles, formerly Chief Naval Constructor of the United States navy. One of these ships will be built at the Fore River yard and the other by the New York Shipbuilding Company.

Judging from such particulars regarding the design of the vessels as are available, they will be the most powerful fighting ships afloat at the time of their launch. Although in displacement they will not exceed our two latest battleships the 'Wyoming' and 'Arkansas,' the disposition of their twelve 12-inch guns is such that they will have a considerably more powerful concentration of fire on every point of bearing except abeam. This advantage is secured by placing the two amidship turrets *en échelon*, or diagonally, an arrangement which permits the four guns in these turrets to be trained dead ahead or dead astern as may be desired. Since the four 12-inch guns in the pair of turrets in the bow and at the stern can be trained axially, this ship will be capable not only of concentrating all twelve guns on either broadside as will be done by our new 'Wyoming' class, but also eight guns dead ahead and eight dead astern as against a fire of four ahead and four astern for the 'Wyoming.' The belt is to be 10 inches in thickness and the speed 22 knots. Apparently, unless some other features of the ship have been sacrificed, this vessel represents the highest development of offensive power yet attempted in the history of warship construction.

That the American tender was lower than that of such firms as Vickers and Armstrong is explained by the fact that armor plate and the steel for the hull construction can be obtained at a lower price in the United States than it can abroad, the difference in this regard being so great as to more than offset the high cost of American labor. Whatever be the reason for our success, the fact remains that the placing of this large contract with an American firm adds greatly to the prestige of our yards and testifies to the high point of excellence to which warship construction has been carried in this country. In this connection we may as well draw attention to the fact that the apathy of the United States to any proposed measures for the resuscitation of our merchant marine has reduced the construction of merchant vessels to such a low point that our leading shipbuilding yards are to-day kept alive almost entirely by government orders for work. Nor must it be argued that the securing of this large warship contract proves that there is no necessity for government assistance in the upbuilding of our merchant marine; for the question of the subsequent cost of running a merchant ship, which is much higher in the American than in foreign service, does not enter into the consideration of warship construction. Moreover, the competition in the construction of merchant steamers is much keener, and the prices are relatively lower than for the construction of warships.

COULD THE EARTH COLLIDE WITH A COMET?

On May 18th next the earth will be plunged into the tail of Halley's comet, and the head of that body will be but 15,000,000 miles away. It is but natural that a thinking man should ask: Is there a possibility that the earth may encounter a comet and thus come to a frightful end?

Curiously enough, it was Halley himself who first pointed out the possibility. Whiston, Newton's successor in the Lucasian chair of mathematics at Cambridge, was so alarmed at "a chariot of fire" which flared up in his day, that Halley was prompted to look closely into its movements. His work led to the startling result that the comet, when passing through the descending node, had approached the earth's path within a semi-diameter of the earth. Naturally, Halley wondered what would have happened had the earth and the comet been actually so close together in their respective orbits. Assuming the comet's mass to have been comparable with that of the earth (an assumption which we now know to have been utterly beyond reason) he concluded that their mutual gravitation would have caused a change in the position of the earth in its orbit, and consequently in the length of a year. This train of thought led him to consider what the result of an actual collision would have been, and he concludes that "if so large a body with so rapid a motion were to strike the earth—a thing by no means impossible—the shock might reduce this beautiful world to its original chaos."

Hence Halley not only dispelled the superstition and the terror which once followed in a comet's wake, but also pointed out a possibility which the superstitious Dark Ages had ever dreamed of. It seemed to Halley not improbable that the earth had at some remote period been struck by a comet which, coming upon it obliquely, had changed the position of the axis of rotation, the north pole having originally, he thought, been at a point not far from Hudson's Bay. The more recent investigations of Kelvin and Sir George Darwin completely upset any such theory.

Since Halley's time the chance of a collision between the earth and a comet has engaged the attention of many astronomical mathematicians. Laplace, for example, painted the possibility of a collision with the earth so vividly that he startled his day and generation. He drew a picture of a comet whose mass was such that a tidal wave some 13,000 or 14,000 feet high inundated the world, with the result that only the higher peaks of the Himalayas and the Alps protruded. Lalande created a panic by a similar consideration of the subject in a paper which was intended for presentation before the Academy of Sciences, but which was not read. Such was the popular excitement, that he felt himself constrained to allay the public fears as well as he could in a soothing article published in the Gazette de France. The masses assumed by both Laplace and Lalande are so preposterous that their theories are no longer seriously considered by any sane astronomer.

Since the day of Laplace and Lalande there have been several comet "scares." Biela's comet crossed the earth's orbit on October 29th, 1832. When that fact was announced, Europe was in a ferment. The orbit of the earth was confused with the earth itself. Such was the popular excitement, that Arago took it upon himself to compute the possibilities of a collision. He pointed out that the earth did not reach the exact spot where the comet had intersected the earth's orbit until a month later, on November 30th, on which date the comet was 60,000,000 miles away. Incidentally he pointed out that a collision was always happily remote. He thought that the chances of a meeting were about one in 281,000,000. Babinet, on the other hand, thought that a collision was likely to take place once in about 15,000,000 years. More recently the entire problem has been considered by Prof. W. H. Pickering of Harvard. By a collision he understands, first, that any part of the earth strikes any part of the comet's head, second, that any part of the earth strikes the most condensed point in the head (the core) as distinguished from the larger nucleus. What the average size of a visible comet's head may be, we have no means of knowing. Young estimates that for a telescopic comet it averages from 40,000 to 100,000 miles in diameter. The head of the great comet of 1811 was 1,200,000 miles, that of Holme's comet in 1892, 700,000 miles, and that of naked-eye comets generally over 100,000 miles.

In the last half of the last century 121 comets, including returns, penetrated the sphere of the earth's orbit. From this Prof. Pickering infers that we should expect to be struck by the core of a visible comet once in about 40,000,000 years, and by some portion of the head once in 4,000,000 years. Since comets' orbits are more thickly distributed near the ecliptic than in other regions of the sphere, the collisions would occur rather more frequently than this, but hardly as often as once in 2,000,000 years, and since it has been estimated that animal life has existed upon the earth for about 100,000,000 years, a considerable number of collisions, perhaps as many as fifty, must have taken place during that interval, in Prof. Pickering's opinion, evidently without producing any very serious results.

The old notions of the tidal effects of comets were based upon an erroneous conception of cometary masses. It seems astonishing that a man of Laplace's wonderful mathematical powers should not have concluded that a body like a comet, which can sweep through the entire solar system without deranging a single one of its members, must have a mass so small that it cannot appreciably affect the waters of the earth. As it is, comets are more likely to be captured by planets (witness the comet families of Jupiter and Saturn) than to derange a member of the solar system or to produce tidal effects.

The plunging of the earth in the tail of Halley's comet naturally causes many to wonder what will be the effect upon the inhabitants of the earth. Similar passages occurred in 1819 and 1861, but no one was the wiser until long after. Some astronomers claimed to have noticed auroral glares and meteoric displays at the time, but whether these were really associated with the comet or not cannot definitely be stated. At all events, it may be safely held that on May 18th next none of us will be aware of the fact that we are literally breathing the tail of Halley's comet. From this it may well be inferred that the wild tales of the possible effects of poisonous gases, tales for which the newspapers are very largely responsible, are utterly without foundation. It is true that a comet's tail is composed of poisonous and asphyxiating hydrocarbon vapors and of cyanogen, but it is also true that the actual amount of toxic vapor is so small that when the earth is brushed by the tail of Halley's comet, the composition of the atmosphere will not be so affected that a chemist could detect it. Flammarion has drawn a vivid picture in his "La Fin du Monde" of the possible effect of passing through a tail highly charged with vapors. He has shown us terrified humanity gasping for breath in its death struggle with carbon monoxide gas, killed off with merciful swiftness by cyanogen and dancing joyously to an anæsthetic death, produced by the conversion of the atmosphere into nitrous oxide or dentist's "laughing gas." No one of any common sense should be alarmed by these nightmares, particularly when it is considered that so diaphanously thin is a comet's tail, that stars can be seen through it without diminution in brightness.

PATENT COMPLEXITIES IN GREAT BRITAIN.

In the course of a judgment in an important patent case before the House of Lords, the supreme tribunal of Great Britain, the Lord Chancellor made very pointed references to the complexity with which patent specifications are sometimes encumbered. During the past few years there has been an increasing tendency to render such specifications as intricate and as voluminous as possible, thereby obscuring the vital issue. Only a few weeks previously the Chancellor complained in another action of the manner in which claim and narrative had been so intimately interwoven that considerable difficulty was experienced in unraveling the real factors in the issue. Such a tendency, the Lord Chancellor pointed out, defeated its own object, for where patent specifications and claims were so framed as to puzzle a student, business men were afraid to take out a license for its working, for fear their interpretation of the patent might be found to be erroneous, be found guilty of infringement, and be mulcted in heavy damages. The particular case in which the Lord Chancellor was constrained to make these comments was in connection with improvements in the casting and trimming of stereotype plates. The court contended that the specification of the original patent was extremely voluminous and complicated, amounting almost to the bulk of a treatise, in which there was infinite redundancy and repetitions, and constant references to illustrations which were somewhat difficult to follow. It was a document which needed a prolonged and penetrating study in order that any one who wished to work out problems in this particular field of industry might know how to avoid all possible risk of infringement.

In the course of his remarks the Lord Chancellor pointed out that inventors who drew up such complicated claims must run the risk of the whole patent's being declared void by the court on the plea of ambiguity. The framing of specifications in this manner he declared to be an abuse of the law, and he gave the warning that it would be checked, if the occasion arose, by the simple process of declaring the patent invalid. These timely remarks have been greatly appreciated by British commercial and manufacturing establishments, and there is no doubt that advantage will be taken to draw up specifications in a more concise and lucid manner.

ENGINEERING.

The Chanute medal, founded by that celebrated engineer, Octave Chanute, and awarded by the Western Society of Engineers for the best paper presented during the year, has been given to Prof Talbot, University of Illinois, for his paper entitled "Tests of Cast Iron and Reinforced Concrete Culvert Pipe," which embodied results of a research extending over a number of years.

The Interstate Commerce Commission points with pardonable pride to the saving of life and limb which has resulted from the operation of the safety appliance law In 1893 one out of every 349 men employed in car coupling was killed, and one in 13 was injured, whereas in 1908, one out of 963 was killed, and one out of 62 was injured—an increase in the factor of safety against death of 181 6, and against injury of 377

In addition to the three dreadnought battleships which are being built for the Brazilian navy, the programme of construction includes ten destroyers of the staunch seagoing type being built by Messrs Yarrow Six are in commission and the seventh recently exceeded her speed of 27 knots during trials on the Clyde, carrying a load of 100 tons. These vessels are 240 feet long and they are propelled by twin reciprocating engines of 8,000 horse-power

Bion J. Arnold has been appointed subway engineer for the city of Chicago, and it is probable that about nine miles of subway will be put under construction forthwith. The city has sufficient funds for this purpose from its accumulation from the street railway company's dividends, and the street-car companies are bound to contribute $5,000,000 The first section will be built in the heart of the city, and will form the center from which later construction will radiate

There is much significance in the recent capture by the Germans of several big contracts in this country The Rhenish-Westphalian works have contracted to build three more 10,000-horse power turbines for the Niagara Falls power plants, which will make fifteen in all with a total horse-power of 150,000 Other German firms have obtained orders to build a series of large coke ovens for the Bethlehem Steel Company The order includes 400 ovens with a capacity of 3,000 tons a day, and the cost will be about $4,500,000

There is much talk in the air about the construction of a 30,000-ton battleship for the United States navy and its cause is to be found in the advent of the new and very powerful 14-inch gun, which recently underwent successful tests at Sandy Hook. If the 14 inch gun is to be installed, and the total number of guns is to remain the same as in the "Wyoming," an increase in displacement becomes necessary Indeed, it is questionable whether even a 30,000-ton ship could mount twelve 14-inch guns and give them adequate protection.

Only those who have witnessed the great congestion on the present subway can understand the supreme satisfaction afforded by the determination of New York city's very efficient Mayor and the Public Service Commission to build at once an additional system of subways at a cost of $100,000,000 The routes include an entirely new north and south subway from the Bronx to the Battery by way of Lexington Avenue and Broadway, and a subway in Brooklyn connecting the lines over the Williamsburg Bridge with the new Fourth Avenue route in Brooklyn, the latter to have elevated extensions to Fort Hamilton and Coney Island

The Federal authorities have approved of plans for the opening of the Delaware River to a navigable depth of 12 feet as far as the city of Trenton, and it is believed that the development of deep-water navigation farther inland will be only a question of time. In Europe stupendous work of this character has been done Manchester spent $80,035,000 on the 35-mile canal, which has made the city of Manchester a seaport, while Duisberg in Germany, 100 miles from the mouth of the Rhine, and Cologne, 150 miles from the sea, are both in free communication by water with the seaboard.

Mr. George Gibbs, Chief Engineer of Electric Traction of the Pennsylvania Tunnel and Terminal Railroad, in a report made at the last session of the International Railway Congress gives some comparative figures of economy of the West Jersey and Seashore Railway and the Long Island Railroad on lines that were formerly operated by steam. During 1908 the Long Island Railroad operated its electric line at 17.80 cents per car mile as against a cost of 27.95 cents for steam train mileage. On the West Jersey and Seashore the costs were 20.46 cents for electric as against 22.30 cents for steam mileage. The relatively unfavorable results on the latter railway are accounted for mainly by the fact that stops were frequent on the steam service of the Long Island Railroad and the steam service therefore was costly; whereas on the West Jersey Road the average number of cars per steam train was twice that of the electric, and much of the service was express with few stops and therefore of an exceptionally economical character.

ELECTRICITY.

The first Edison medal of the American Institute of Electrical Engineers was awarded to Prof Elihu Thomson for his achievements in electricity, on the occasion of the anniversary dinner of the Institute This medal was founded by friends of Mr Edison, and is intended to commemorate his work

A remarkably long wireless transmission was recently recorded by the steamship "Tennessee," five days out from Honolulu, which succeeded in catching a message from Table Bluff on the coast of California. The message was a weather report, which was afterward verified by the Navy Department The distance of transmission was 4,580 miles

A recent test of wireless telephony was made to show its value for transmitting music Several selections were sung in a transmitter at Park Avenue and Fortieth Street, New York, and were listened to by a group of newspaper men at the Metropolitan Tower At times the singing was very clear, but frequently it was impossible to hear anything but a confused blur of sound

A portable transformer drying apparatus has been devised to dry out transformers that have become moist during shipment or storage The apparatus consists of a furnace adapted to burn wood or charcoal A current of air heated by the furnace is forced through the transformer by means of a blower driven by a small motor The air, before reaching the blower, is filtered through several thicknesses of cheesecloth

The telephones used on the steamship "Lusitania" are quite interesting The induction coil condenser, and bell of the instrument are inclosed in a small white enamel box, and the switch hook which projects from one side is provided with a special retaining device to prevent the receiver from being knocked off by the motion of the ship The receiver is allowed to rock on the hook, otherwise the lever would lift and make a false connection when the ship was pitching and rolling

A recent number of the Electrical World describes a very interesting electrical installation on an Illinois farm The power plant consists of a gas-producer installation supplying a 25-horse-power two-cylinder gas engine to which a 16-kilowatt 125-volt direct-current generator is belted The engine also runs a pump which supplies an elevated water tank The current is used to light 150 lamps, which are used in the family residence and a tenant house, as well as in various barns, corn cribs, and other buildings

A new type of long-distance telephone was recently tested successfully over a circuit extending from New York to Chicago by way of Pittsburg, and return The distance was 1,825 miles The system, which is the invention of Dr Tardieu of Arles France consists in raising the pitch of the message two octaves and a third by means of a combination of drums At this high pitch the waves are sharp and short, and can be transmitted over a greater distance than is possible with the sound waves of ordinary conversation At the receiver the pitch is again restored to normal

At a recent meeting of the Institute of Electrical Engineers in London a differential electric thermometer was described by Prof J A. Fleming The thermometer consists of two large glass tubes, sealed air tight at the top and bottom and connected by a tube of fine bore in which is a thread of colored water containing a bubble of air in the center The strips whose resistance is to be measured are placed in the tubes, and one of them is connected with a source of high frequency current while the other is connected with a source of direct current By introducing resistance into the circuits, the heat may be regulated until it is the same in both tubes, as will be indicated by the bubble remaining in the center of the small connecting tube The value of the resistances will vary inversely as the square of the current

A report on the trackless trolley systems near Vienna has recently been made by the United States Consul General there situated The current collector used consists of a small frame supported on the grooved wheels which run on the positive and negative wires. The wheel is prevented from jumping the wires by a weighted pendulum A cable of about 10 or 12 yards connects the current collector with the car When two cars meet, the trolley connections are interchanged, and they can proceed on their way This is an improvement over the track system with turn-outs at various points, which make it necessary for the first car that reaches the turn-out to wait until the second car arrives. The total running cost of this system for a car operating 75 miles a day is from $5 20 to $6 80 or from 7 to 9 cents per mile

A five-mile test of the Edison Beach storage battery car was made here last week over the 29th Street horse-car tracks. The car carried a number of engineers, who were to judge of its availability for street-car service in New York. If their decision is favorable fifteen of the cars will be put into service.

SCIENCE.

Dr. E. E. Barnard of Yerkes Observatory secured photographs of Comet A 1910 on January 21st, 24th, and February 1st, 3rd, 4th, and 6th Cloudy weather prevented the taking of any other photographs Dr Barnard informs us that one of the interesting features of this comet was an extension from the head about one-quarter of a degree long toward the sun This extension was in a line with the prolongation of the southern edge of the tail

The mechanical laboratory of the Polytechnic Institute of Worcester, Mass, has undertaken a study of the relative thermal conductivity of rolled copper and of copper deposited by electrolysis and not rolled The conductivity of the rolled copper was found to exceed that of the electrolytic copper by 30 per cent. This is an interesting instance of the change in the internal structure of metals which is produced by mechanical treatment

Cobalt and tin, in the liquid state, are miscible in all proportions, but solid cobalt dissolves only about 3½ per cent of tin The two metals form two definite compounds CoSn and Co_2Sn Cobalt and antimony also mix in all proportions in the liquid state Solid cobalt can take up 12½ per cent of antimony, with which it forms the compounds CoSb and $CoSb_2$. Cobalt and lead form no definite solid compound and, even in the liquid state each dissolves only a small quantity of the other The same law governs the alloys of cobalt with bismuth and thallium. Cobalt and zinc, fused together, deposit alloys in which the definite compound $CoZn_4$ has been found Cobalt and chromium mix in all proportions in the solid as well as in the liquid Cobalt and silicon mix in all proportions, in the liquid state, and form five definite solid compounds Co_2Si, CoSi, $CoSi_2$, $CoSi_3$, Co_3Si These recent determinations possess especial interest as very little study has been given to the alloys of cobalt

European sportsmen are beginning to fear that game will be made scarce by the multiplication of aeroplanes, balloons, and other aerial vessels It is well known that where many kites are habitually flown they have the effect of driving the game to other districts The effect of a kite however, is very small in comparison with that of an aeroplane or a dirigible balloon A German landowner, strolling over his estate saw two black storks which had been standing, with a number of ducks, on the bank of a pond, suddenly take to flight, without apparent reason The next instant the ducks quacking loudly, took wing and were soon out of sight Looking around for the cause of the birds' affright the proprietor saw a dirigible balloon, which the birds had probably perceived before it became visible to him He learned afterward that deer browsing in the fields, had been frightened by the sight of the airship or by the noise made by its propellers and had fled to the forest All animals are terrified by airships Partridges quail, and other game birds crouch and hide while domestic fowls utter loud warning notes the instant they perceive the monstrous bird of prey The Swedish aeronaut Von Hoffken, while sailing at a moderate elevation observed that elks, foxes hares and other wild animals fled at his approach and that the dogs ran howling into the houses While the Zeppelin III was going from Düsseldorf to Essen the aeronauts on board noted that horses and cattle galloped frantically over the fields on catching sight of the airship

One of the scientific developments of recent years has been the formation of international organizations for the consideration of important subjects International congresses in zoology in chemistry in medicine and in other subjects meet at regular intervals usually every three years, for the purpose of freely discussing the problems of their specialties These have resulted in international committees Thus it happens that there is an International Union for Solar Research, with a special committee on solar radiation The desirability of establishing an international scale for the comparison of observations in solar radiation is obvious It is fortunate that Mr C G Abbot, director of the Smithsonian Astrophysical Observatory has succeeded in perfecting the construction of an instrument used for such a purpose which is called "pyrheliometer" These instruments, tested by him both in Washington and at Mount Wilson in California have been found to yield satisfactory results A limited grant from the Hodgkins fund of the Smithsonian Institution was made for the construction of four of these silver disk pyrheliometers These have now been completed and are about to be sent to investigators in widely separated localities for use in obtaining constants The first of these instruments will be sent to M Violle who is chairman of the committee on solar radiation of the Solar Union, and by him will be placed in the meteorological station. established by the French government on the Pic du Midi in the Pyrenees in the south of France The second will go to M Chistoni of the Physical Institution in Naples and will be sent to the observatory on Mount Vesuvius.

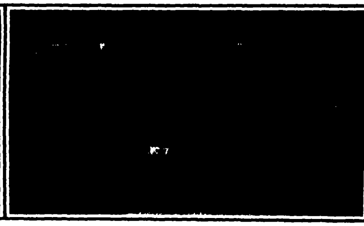
TWO REMARKABLE SHOWS

NOVELTIES IN MOTOR BOATS AND AEROPLANES

The sixth annual motor boat show to be held in Madison Square Garden opened on February 19th and lasted one week. The show this year was larger than ever before, there being a great number of boats of various speeds and sizes exhibited. These varied from 10 feet to 40 in length and in motive power from 1 to 100 horse-power. Altogether some fifty boats of various types were exhibited, representing a total value of $.0,000. The largest exhibit of any one firm was that of the Electric Launch Company of Bayonne, N. J. In addition to an electric launch having a radius of 100 miles on one charge, this company showed a 21-foot mahogany yacht tender fitted with a 40-horse-power gasoline motor and capable of a speed of 22 miles an hour, a larger boat fitted with the same size motor and having a speed of 18 miles an hour, and a 35-foot craft fitted with a 6-cylinder 60-horse-power motor and capable of a speed of 23 miles per hour with six or eight passengers. The most pretentious "Elco" was a high-speed 54-foot cabin launch fitted with a 60-horse-power 4-cylinder Standard motor, and capable of a speed of 15 miles per hour. This boat has a large open cockpit fore and aft for fair weather, and a spacious cabin amidships. The engine is placed forward in a separate compartment and the controlling levers and steering wheel are placed side by side. Other firms exhibited cruisers comparable in size to the boat just mentioned and fitted with all the conveniences needed on this type of craft.

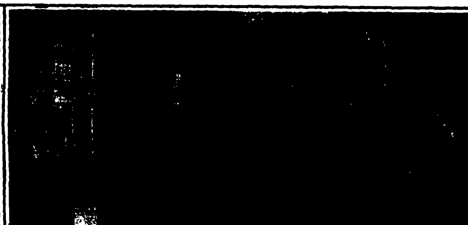
(*Continued on page 209.*)

Paulhan's Langley type prize-winning model aeroplane



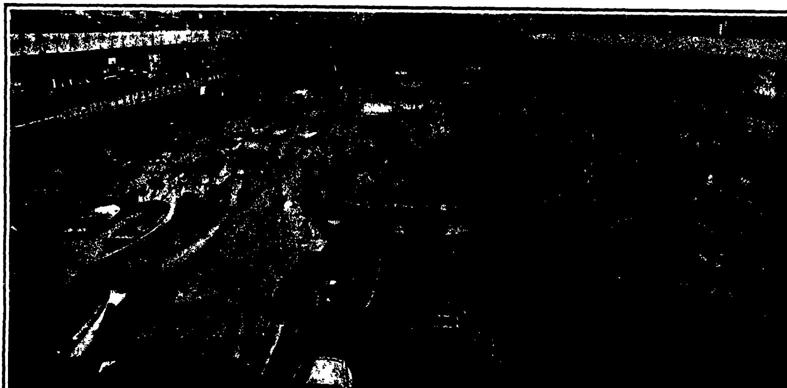
General view of Boston Aeronautic Show; Monoplane Exhibit

The Beach Antoinette type monoplane appears in the foreground and the Burlingame monoplane in the semi-distance. The gliders are seen between these two machines and the Herring biplane appears on the platform in the distance.



The novel L. A. W. biplane, with its revolving cylinder, air-cooled 2-cycle motor. The heavy curves and construction of the planes is a noticeable feature.

Interesting full-size Aeroplanes exhibited at the Boston Aeronautical Show

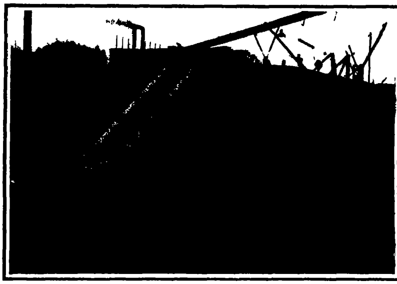


General view of the Sixth Annual Motor Boat Show in Madison Square Garden, New York.

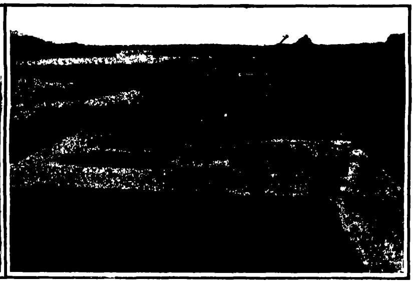
TWO REMARKABLE SHOWS.—NOVELTIES IN MOTOR BOATS AND AEROPLANES.

RAPID PROGRESS OF THE NEW YORK STATE BARGE CANAL

A RECORD OF RECENT ACHIEVEMENT



View of lock No. 5 at Northumberland

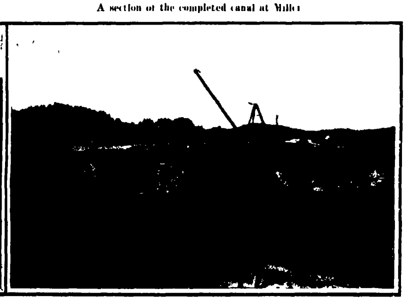


One wall of a lock, showing massive character of the concrete masonry

Erecting the lock gates at lock No. 11 at Comstock.

A section of the completed canal at Miller

Laying the concrete floor, lock No. 12 at Whitehall.



Another view of Comstock lock No. 11 showing retaining wall.

RAPID PROGRESS OF THE NEW YORK STATE BARGE CANAL

The large amount of work done on the New York State Barge Canal during the past year augurs well, not only for the completion of this great work within the contract time but for its being done within the estimate of total cost of $101,000,000. Almost as much construction work was completed during the year as was accomplished during the whole period of construction preceding, and the plans that were worked out to completion equal 80 per cent of the amount of similar work done in any previous two years, that is, if we consider the mileage and the size of the estimate.

On January 1st, 1910, some 314 miles of the canal, or 75 per cent of the entire work, were under contract, the remainder of the plans were nearing completion and will soon be ready for letting, and the aggregate of the work under contract is $54,138,329. It is satisfactory to know that this has been accomplished at a saving of $2,653,208 over the estimate of 1903 for the same work. Construction work to the value of more than $16,000,000 has been done, nearly one-half of it during the year 1909, fifteen out of the fifty four locks are practically completed, and by the spring of next year the eight movable dams of the Mohawk River will be in operation. The work has now reached a stage where it is possible to predict both the time and cost of the completion of the entire project.

By studying the accompanying map, profile, and cross sections of the canal in connection with the following outline of its principal features, an adequate conception of this great work may be gathered. Leaving Lake Erie at Buffalo at an elevation of 565.6 feet above sea level, the new canal follows the Niagara River to Tonawanda Creek and thence runs easterly to the Oswego River and to a junction with the Hudson River at Waterford. After entering Tonawanda Creek it follows the stream to Lockport, where a descent of 103 feet is made by means of two locks; thence there is a 60-mile level to Rochester. Beyond Rochester the new canal coincides with the old canal until it enters the River Clyde near Lyons. Beyond Lyons the old canal route is abandoned and a new route is laid to the north of the old work. The Clyde River and the Seneca River are followed to Three Rivers, where the Seneca and Oneida unite to form the Oswego River. A new stretch of canal will be formed in the bed of the river, running north to Lake Ontario, the

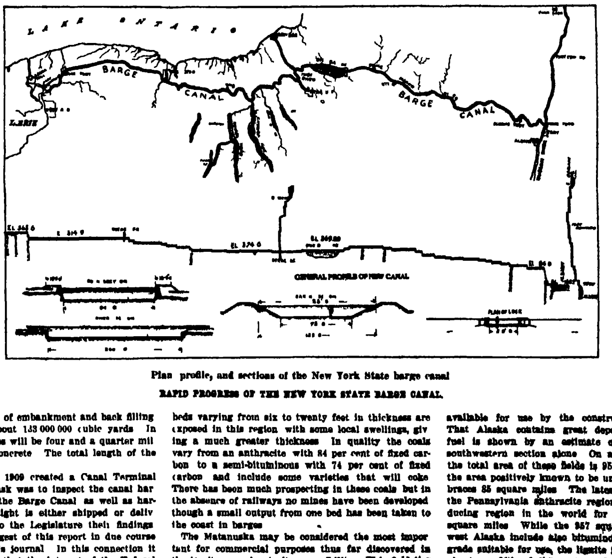
depth of the river being increased by the use of fixed dams From Oswego River the canal extends easterly following the river to and across Oneida Lake and through the valley of Wood Creek to the city of Rome Here the canal crosses the divide by a series of locks and enters the valley of the Mohawk River

The canal in the valley of the Mohawk between Utica and Schenectady will be provided with nine movable and two fixed dams eight of the movable dams will have a maximum lift of 15 feet and a maximum depth on the sills of 20 feet and these structures will serve to control the high floods of the Mohawk The canal enters the Hudson River at Waterford by a series of five locks which will bring it down from an elevation of plus 1 1 feet to tide level From Waterford the important branch known as the Champlain Canal runs north to the lake As far as Fort Edward the location lies in the Hudson River and beyond Fort Edward it will be on an entirely new location making entry into Lake Champlain through Wood Creek which will be canalized by the use of fixed dams The Canadian government has planned the construction of a waterway with a depth of 12 feet from the mouth of the new canal through Lake Champlain to Montreal

Naturally a work of this magnitude passing through an undulating country and through several important cities involves an immense amount of structural work in the way of dams locks bridges and other masonry and steel work There will be a total number of fifty four locks whose lift will vary from 6 feet to a maximum of 40½ feet these taking the place of the seventy two locks of the old canal All of the locks will be 45 feet wide with a workable length of from 300 to 310 feet The masonry work throughout the whole canal will be of concrete All lock gates will be of steel electrically operated For the control of rivers and streams and the impounding of water for summit supply there will be thirty five dams of the fixed and movable types

The total quantities of excavation and construction are necessarily very large including in round numbers 58 000 000 cubic yards of dredging 57 000 000 cubic yards of earth excavation, 11 000 000 cubic yards of rock excavation and about 10 000 000 yards of embankment and back filling making a total of about 133 000 000 cubic yards In the masonry structures will be four and a quarter million cubic yards of concrete The total length of the canal is 442 miles

The Legislature in 1909 created a Canal Terminal Commission whose task was to inspect the canal harbors connected with the Barge Canal as well as harbors where canal freight is either shipped or delivered and to report to the Legislature their findings We hope to give a digest of this report in due course in the columns of this journal In this connection it is of interest to note that the interest of the Federal government has been enlisted in the project to form a large terminal harbor in Jamaica Bay with entrance channels at sufficient depth to accommodate seagoing vessels This improvement will have an important bearing on the question of canal terminal facilities



Plan profile, and sections of the New York State barge canal

RAPID PROGRESS OF THE NEW YORK STATE BARGE CANAL.

The Anthracite Coal Beds of Alaska.

BY DAY A [illegible] WILLEY

The extent of its gold and copper deposits has given Alaska its principal reputation for mineral resources The quality and area of these ores have called public attention to them to the neglect of other minerals and the bulk of the mining in the territory has been done to secure these ores Consequently coal mining and lumbering are practically undeveloped industries

Although the geologist and mineralogist have been investigating in Alaska for a period of years most of their work has been confined to the region along the coast and the territory traversed by navigable rivers such as the Yukon. Owing to the difficulty of examining and mapping the interior and especially the northern portion of Alaska, accurate information of its mineralogy is available in but a small fraction of its total area Here however the study of the formation has been so thorough that the existence of very large deposits of coal has been revealed and accurate estimates made showing the locations of the veins also the thickness while the quality of the fuel has been carefully analyzed by elaborate tests. It may be added that the conclusions of the United States Geological Survey agree with the reports of experts who have been sent to Alaska to get data for mining and investment companies

The investigation of the coal bearing area has been largely centered in the vicinity of the coast and two regions have been so thoroughly examined as to prove that fuel is another resource of Alaska of great importance Though Tertiary coal bearing rocks are known to cover a considerable area in the southern part of Admiralty Island and on adjacent islands of southeastern Alaska the included coal of this region has little present fuel value The beds are from a few inches to two or three feet in thickness and the coal is of a low grade lignitic character There are two known areas of high-grade coal—the Bering River field in the Controller Bay region, and the Matanuska field north of Cook Inlet. The Bering River field lying about 25 miles from tidewater at Controller Bay embraces 2 64 square miles containing anthracite and 20 2 square miles bituminous coal The coal bearing rocks trend to the northeast into the unsurveyed high ranges and it is quite possible that there may be an extension of the coal fields in this direction Coal beds varying from six to twenty feet in thickness are exposed in this region with some local swellings, giving a much greater thickness In quality the coals vary from an anthracite with 84 per cent of fixed carbon to a semi-bituminous with 74 per cent of fixed carbon and include some varieties that will coke There has been much prospecting in these coals but in the absence of railways no mines have been developed though a small output from one bed has been taken to the coast in barges

The Matanuska may be considered the most important for commercial purposes thus far discovered in the territory owing to its accessibility This field lies about 25 miles from tidewater at Knik a northerly embayment of Cook Inlet. As Cook Inlet is frozen during the winter however the distance to an open seaport must be measured to Resurrection Bay on the east side of Kenai Peninsula, about 150 miles from the coal field There are several months of the year when Cook Inlet could be used as a waterway

The coal of these deposits as investigated by Alfred H Brooks the eminent mining expert associated with the Geological Survey varies in quality from a subbituminous to a semi bituminous, with some anthracite, and is included in folded and faulted Tertiary or Eocene shales sandstones and conglomerates, aggregating 3 000 feet in thickness The coal beds vary from 5 to 36 feet in thickness and the total area known to be underlain by coal aggregates 46½ square miles. However as much of the field is covered by gravels and none of it has been surveyed in detail, the coal-bearing area may be much larger. The total area of which may prove to be coal-bearing [illegible] square miles Up to the present time there has been no means of transporting this coal to market, [illegible] as stated no mining has been done, but many holes have been opened in prospecting

The chemical analysis of specimens of coal taken from a large number of veins practically covering this entire district gives the following results

	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulphur
Anthracite—					
Bering River average of seven analyses	7 [illegible]	6 15	78 [illegible]	7 74	1 [illegible]
Matanuska River	2 [illegible]	7 03	84 [illegible]	6 [illegible]	0 [illegible]
Bituminous—					
Matanuska River coking, average of sixteen analyses	2 71	20 [illegible]	65 [illegible]	11 60	0 [illegible]
Subbituminous—					
Matanuska River	6 [illegible]	25 40	40 44	5 [illegible]	0.[illegible]
Koyukuk River one sample	4 47	34 [illegible]	48 [illegible]	12 [illegible]	
Nation River one sample	1 [illegible]	40 05	55 65	6 04	0 [illegible]
Alaska Peninsula, average of five analyses	2 84	[illegible]	40 13	1 [illegible]	1 [illegible]
Cape Lisburne, average of eleven analyses	9 [illegible]	38 01	[illegible] 19	5 45	0.[illegible]
Anaktuvak River one sample	6 [illegible]	[illegible]	46 [illegible]	12 [illegible]	0.54

Since the anthracite coal deposits of Pennsylvania would be naturally contrasted with Alaskan as a fuel element some analyses of the more notable Pennsylvania grades may be given

Pa. Region	Water	Volatile Hydrocarbon	Fixed Carbon	Fuel Ratio.	Ash	Sulphur.
Wilkesbarre	2 40	4 86	86 97	19 [illegible]	[illegible]	0 [illegible]
Lehigh	1 78	3 [illegible]	85 09		[illegible]	0 [illegible]

A comparison of the analyses of the coal in the Matanuska field and the two regions yielding the highest grade of anthracite in Pennsylvania would indicate that the Alaskan is of slightly better quality for generating heat. Its percentage of fixed carbon 84 22 is greater than the percentage in the Wilkes-Barre region while the percentage of ash is 2 06 less than the other The proportion of sulphur 0 57 is the least in any anthracite coal found thus far in America.

While the area of the Matanuska region is limited in comparison with the Appalachian field it is but a small area of the territory known by examination to contain deposits of anthracite and bituminous many available for use by the construction of railways That Alaska contains great deposits of high grade fuel is shown by an estimate of the beds in the southwestern section alone On a conservative basis the total area of these fields is 957 square miles, and the area positively known to be underlain by coal embraces 85 square miles The latest estimated area of the Pennsylvania anthracite region—the greatest producing region in the world for this grade—is 480 square miles While the 957 square miles of southwest Alaska include also bituminous and lignite of a grade suitable for use, the lignite is contained in only about one-fifth of the area, or less than 200 square miles the remainder representing bituminous and anthracite territory; but as already stated the experts who have explored this region agree that the anthracite deposits that can be economically mined and made easily accessible by rail to seaports form a fuel resource of such proportions that it would supply Alaska and the Pacific States for an indefinite period

The formation in the Matanuska is such that many of the veins can be reached by short tunnels without the need of vertical shafts while the expense of elevating may also be avoided The veins frequently outcrop on the surface. In short the natural location permits mining at a minimum cost

The beds referred to are not distant from the extensive copper mines located near the Copper River and exploited by the Guggenheim syndicate. In connection with this industry a railway [illegible] has been completed to the coast [illegible] for the purpose of [illegible] by water. [illegible]

[illegible] the company to begin the building of a railroad to this field, as a route is available over which a railway can be easily constructed owing to the formation of the country. It will be about 175 miles in length. Another route had also been surveyed over the route already referred to, terminating at Resurrection Bay. This would allow water transportation at all seasons of the year because of the freedom from ice while the depth of the bay is such that the largest ocean carriers can take on cargoes at the coal piers. Up to the present time this great coal field has been unproductive on account of no transportation facilities, the only operations being for test purposes. This region is of unusual interest at present owing to the Congressional investigation of the timber and mineral resources of the territory in connection with the Ballinger Pinchot controversy.

Coal was found near Cook Inlet by the Russians as far back as 1855 but the entire output of the territory has been insignificant as shown by the product of less than 10 000 tons of all kinds in 1909—none of it anthracite.

THE "UTAH"—OUR LATEST DREADNOUGHT

The spirited drawing on the front page of this issue represents our latest dreadnought the Utah recently launched from the yards of the New York Shipbuilding Company Camden N J. She is shown steaming in a gale of wind against a heavy Atlantic sea, and in spite of her great length of 521½ feet the huge vessel as she rides over the long Atlantic rollers will do her full share of pitching and rolling as she climbs and descends each majestic sea. Several cable lengths to starboard is a sister ship that is running down the slope of a sea whose crest is sufficiently high to hide all but the funnels and masts.

These conditions are no mere creations of the artist's fancy, for we have recently seen a series of pictures taken on our fleet when it was steaming northward in a heavy gale on the Pacific in which only the tops of the funnels and the fighting masts of some of the vessels are visible, the ships lying deep in the trough of the waves.

But although the Utah in spite of her full load displacement of over 23 000 tons will be to some extent the sport of the elements, her great weight and size will make her a far steadier gun platform than is afforded by the 16 000-ton Connecticut or the 12 000 ton "Maine", and herein lies one of the most important advantages of the big over the medium size warship. The Utah, which is a sister ship to the Florida, now nearing completion at the New York navy yard, is 521½ feet long, 88 feet 2½ inches wide, and on a normal displacement of 21 825 tons her draft is 28 feet 6 inches. At normal displacement it should be explained she will have a full supply of ammunition and two thirds of full supply of stores and fuel. The ship is an enlarged and improved North Dakota, with 3 feet more beam, 1 foot 7 inches more draft and 1 835 tons additional displacement. She is equipped with 4 screw Parsons turbines of 28 000 horsepower which are designed to give her a contract speed of 20.75 knots. She will carry 2 500 tons of coal and 400 tons of oil fuel and steam will be supplied by boilers of the Babcock & Wilcox type. The Utah will be manned by 60 officers and 954 men, her total complement being 1 014. This is about the number of men that were carried on the old wooden three-deckers of the largest size, and in this ship for the first time the crew of a modern battleship equals that of one of the olden days.

Like the North Dakota and "Delaware" the Utah carries ten 12-inch guns in the main battery. They are mounted in pairs in balanced turrets, the disposition of which is shown very clearly in our engraving of the ship. The foremost pair of guns has an elevation of about 28 feet above the normal waterline. The second pair has a command of about 40 feet. The guns of turret number 3 have a command of about 32 feet, and those in numbers 4 and 5 of about 25 feet. All of the guns being mounted on the center line, they can all be trained on either broadside. Dead ahead the Utah can fire four 12-inch guns, and the same number dead astern. It will thus be seen that maximum broadside fire is gained at the expense of end-on fire, for the "Minas Geraes" recently built for the Brazilian government can fire eight guns ahead or astern, and the German and British battleships six guns. Most of the fighting, however, in all probability, will be done broadside to broadside; and the center line disposition, which originated in the Bureau of Construction and Repair, is probably the most effective that can be adopted.

The secondary battery consists of sixteen 50-caliber 5-inch guns. [illegible]

water, and of the guns is exceptionally well worked out in these vessels, being in this respect an improvement even on the "North Dakota" herself one of the best protected ships ever built. In the first place with a view to limiting the destructive effects of a torpedo blow particular attention has been paid to the question of cellular and compartmental subdivision. Even in the event of most serious underwater injury such as might be done by a floating mine the ship is able to concentrate on any compartment or set of compartments such a great capacity of pumps that she would be able by the aid of these alone greatly to mitigate the effects of such a blow.

The armor plan of the Utah is probably the most complete and effective yet put upon any ship. The main belt over 8 feet wide has an average thickness amidship of 11 inches. Above this is a second belt 8 feet wide of an average thickness of 9 inches. The lower waterline belt is continuous from stem to stern and the upper belt extends from the wake of the forward to the wake of the aftermost turret. The turrets of the 12 inch guns have from 12 to 8 inches of protection. The 5 inch secondary battery amidships is protected by 6½ inches of armor and a similar thickness protects the casemates of the six guns at the bow and stern. Between each pair of 5 inch guns is a splinter bulkhead of 2 inch armor and back of each battery is a longitudinal wall of 3 inch armor which closes in each 5 inch gun. To reach the base of the smokestacks any shell would have to pass through 9½ inches of armor—a superb protection.

It will be noted that the ship is provided with two of the new lattice work fire-control masts with which all our latest ships have been equipped. The handling of the boats is done by two boat cranes placed abreast of each other one on either side of the after smoke stack. In this ship as in all our dreadnoughts the officers are berthed on the main deck forward below the forecastle deck, the crew accommodation being aft. This places the officers near the bridge and convenient ly to their post of duty.

The keel of the Utah was laid March 1 (th 1909) so that considerably less than a year has elapsed between the laying of the keel and the launch. In less than a year from the present time if all goes well this fine ship will have her trials, a speed in warship construction which is greatly to the credit of the New York Shipbuilding Company. Particular interest will attach to the trials of this vessel for the reason that she will be the first of American battleships to be propelled by 4 screw Parsons turbines.

American Homes and Gardens for March

The current number of American Homes and Gardens contains pictures of interesting California bungalows costing from $1 000 upward, an article on the furnishing of the apartment by a well known author, an article on the interior decoration of the home devoted to appropriate wall papers for the various rooms of the house, and views of a number of interesting houses showing interiors, exteriors and floor plans. The fourth prize garden of the American Homes and Gardens competition is also published in this issue as well as garden notes devoted to fifteen good lilies. There is also an article on open-air orchard heating and an article on the combined forcing bed and storage pit. One of the most interesting articles of the paper one which is profusely illustrated describes the water gardens of California. Trimming street and lawn trees, a timely subject, is well treated by an experienced writer. The historic mansions of the Rappahannock River are always interesting, and the illustrations of "Kenmore", the home of Betty Washington, is one of the important features of this number.

The Current Supplement

The current SUPPLEMENT No 1783 contains an unusual number of timely and interesting articles. Dr M Wilhelm Meyer asks "What would we do if one of these days the sun were extinguished?" He considers the problem most instructively. Prof O N Witt, the distinguished German chemist, contributes an article on the development of technological chemistry during the last forty years. An abstract is published from a paper read before the Society of Civil Engineers by M Georges Claude on some interesting industrial applications of liquid air and oxygen. A most interesting equatorial telescope is in operation at the Urania-Zürich Observatory in Switzerland. This instrument is described by Mr F C Perkins. Some photographs are reproduced which were taken by a photographer whom Latham recently took aloft with him at Louvercy, France. The pictures are probably the first ever published in this country taken from an aeroplane. Mr Marconi's Nobel prize lecture on progress in wireless telegraphy is concluded. Lieut John C Soley U S N writes on the seismic period of 1909. As the result of investigations carried on during the last seventy-five years it has become possible to establish on a firm basis criteria for instituting exact comparisons of the structure of the brain in the various groups of vertebrates. These criteria are discussed in an article entitled "The Evolution of the Brain".

Correspondence.

HOW TO MAKE THE "ALABAMA" AND "MAINE" INTO PRE-DREADNOUGHTS

To the Editor of the SCIENTIFIC AMERICAN

As a reader of the SCIENTIFIC AMERICAN I am particularly interested in the articles on the naval development.

I wish to know through your paper why the following changes would not be practical in remodeling the battleships Idaho and Mississippi. Bearing in mind the results gained by adding 20 feet in length to the Maine class over the Oklahomas, which equals 948 tons displacement, 5 603 horse-power, 2 knots speed, 2 6-inch guns with ammunition and 400 tons of coal.

I would cut these ships in two just aft the boiler rooms and build 30 feet, keeping as near the same beam as possible 77 feet. This 30 feet would be used almost entirely for boilers, engines and coal.

I think that another set of boilers could be installed adding one half to the boiler power. A new set of engines would have to be built to handle the 15 000-horse power thus developed and I think that the speed would be raised at least 1¼ knots, not much of an increase but enough to allow these ships to steam with the 18 knot Louisiana class without reducing the speed of the whole fleet to 17 knots. I would replace the 8 inch guns with four 10-inch 4 -caliber guns and add two 7 inch and four 3 inch guns to their present batteries. Thus we would have the following results:

Present	Remodeled
Length 375 feet to	405 feet
Beam 77 feet to about	78¼ feet
Displacement 13 000 tons to about	14 500 tons
Horsepower 10 000 to about	15 000 H P
Speed 17 knots to about	18¼ knots
Bunker capacity 1 7 0 t ns to about	2 100 tons

Battery 4 12 in, 4 10 in, 10 7 in, and 16 3 inch guns. The armor to remain the same as originally designed.

This would be a rather costly change but when a warship is needed the expense is a small item and these two ships with the increased speed and heavy batteries would be a welcome addition to our first line of pre-dreadnoughts.

W W BASS

Chicago Ill

[Such changes as are suggested by our correspondent would be too costly for the benefits secured. It would not be possible to install four 10 inch guns—the weights of guns, turrets, etc. would be prohibitive. The money would give more fighting value if applied to entirely new ships of the dreadnought class.—ED.]

Death of Prof Amos E Dolbear

Prof Dolbear died at Bedford Mass on February 23rd at the age of seventy four. He was widely known as an inventor of electrical devices. Perhaps his investigations in wireless telegraphy brought him more into public prominence than any other, but the result was an infringement suit in which he unsuccessfully sought to restrain Marconi from continuing his experiments.

Prof Dolbear took the degree of B A at Wesleyan University in 1866 and the degrees of M A and M E at the University of Michigan in 1867. From 1866 to 1867 he was instructor in Chemistry at the University of Michigan. Then he occupied the chair of Assistant Professor of Natural History at the University of Kentucky from 1867 to 1868. From 1868 to 1874 he was Professor of Physics and Chemistry at Bethany W Va. From 1874 to the time of his death he was Professor of Physics and Astronomy at Tufts College. His scientific investigations included the study of light and electrical phenomena, the properties of the ether, magnetic telephony, static telephony, heavy current ammeters, cables for telegraphic and telephonic work, wireless telegraphy and properties of matter.

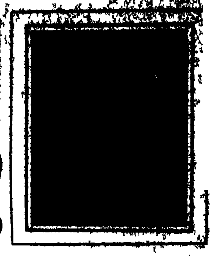
Comet B 1910

Prof Pidoux of Geneva Observatory Switzerland has cabled to Harvard College Observatory stating that he discovered a comet on February 20th in R A 0 h 16 min 22.1 sec and Dec +7 deg 50 min and 41 sec. The daily motion in right ascension was —22 min 24 sec and in declination —24 min. The new comet is not very far from Halley's comet. According to the corrected ephemeris of Crommelin the position of Halley's comet at the time was R A 0 h 41 min 29 sec, and Dec +7 deg [illegible] min.

According to Electrical Engineering a definite proposal has been put forward for the construction of a tunnel between Denmark and Sweden starting at Copenhagen and connecting up with Malone. Connection would be made on the way with the small islands of Amager and Saltholm and the electric trains which it is proposed to work through the tunnel would run on the surface on these islands in order to reduce the underground journey as much as possible. If the scheme is carried out it is estimated that the trip could be made in 1½ hour.

OSTRICH FARMING AS AN INDUSTRY

BY NEWTON FOREST



Does ostrich farming pay? The question is asked by almost everyone who visits an ostrich farm. The answer is that when an acre of alfalfa will furnish a home for four birds with food enough to maintain them throughout the year, when an ostrich will yield annually about two pounds of feathers with an average value of $20 a pound, and from thirty-six to ninety eggs which may be used for incubation or may furnish food at the rate of nearly four pounds to the egg if the owner does not wish to increase his troop, ostrich farming does pay, and pays well.

There is nothing very lovable about an ostrich as there usually is about other domestic animals. But however lacking in personal charm it may be, the big bird is a money producer. A head of cattle eats sixty-five pounds of alfalfa in a day, an ostrich ten pounds. This head of cattle at five years old is worth $40, and an ostrich at that age is worth $2[illegible]0. There is nothing to the cattle but meat. At ten months the ostrich will produce $10 worth of feathers, and thereafter from $35 to $1[illegible]0 worth of feathers annually for a long period of years. Though an ostrich is matured at the age of five and is reproducing, its average life is about that of a human being. The bird does not begin to decline until it is fifty years old. Many, however, produce fine plumage at the age of seventy-five.

There is as much difference in the breed of ostriches as there is in any other animal. Some of the California and Arizona male birds are rated at as high as $[illegible] 000 each, but ordinarily the value averages about $400 for a one-year-old bird and about $100 for a chick. Some of the cocks weigh as much as [illegible]00 pounds and stand over ten feet high.

It has of late years been found that a great deal of money can be made in ostrich farming. Especially so where alfalfa or lucern can be raised on irrigated lands. In the Salt River Valley in Arizona there are about 20 000 acres of rich land soon to be made richer and more productive through immense irrigation works on which the United States is spending $6 000 000. Such a climate is an ideal one for ostrich farming, as the farms in that locality have already proven by their successful operations. While the birds thrive best in a warm, dry climate, they can be grown in any of the southern States and Territories of this country. In a moist climate, however, they would have to be protected from cold and rain.

It is only a little more than two decades ago since the first ostriches were brought into the United States with the serious purpose of attempting their culture here. Before that time the only birds seen in this country had been adjuncts to circuses. To-day, exclusive of those in zoos, there are some four thousand birds on the American continent. Probably half of this number are the progeny of a single pair owned in Arizona in 1891.

The female ostrich matures much earlier than the cock, beginning to lay fertile eggs when she is about three and a half years old. The nest is nothing more or less than a hole scratched in the ground, which is done by the male bird. At first the hen may not take to the nest, but may lay her first eggs on the ground, whereupon the male will roll them into the nest. Generally, after the male has put three or four eggs into the nest, the female will take to it. She will then lay an egg every other day until about sixteen eggs have appeared in the nest. An ostrich egg is nearly eight inches long and about six inches in diameter. It makes a good omelet and is excellent when scrambled. One egg will make as much omelet as three dozen hens' eggs. A full-grown bird has been known to produce over three hundred pounds of egg food in a year.

An annual increase of about fifty per cent of a flock is secured mainly through the use of incubators, though on every farm a few paddocks are maintained, each for the sole occupancy of a pair of birds. Three times a year the hen begins to lay. She does most of her setting during the daytime, the male bird attending to that part of the household duties at night. He will usually go on the nest about five o'clock in the evening and remain there until eight o'clock next morning. It is thought that the color of the sexes has something to do with developing these instincts. The male, being black, is not so easily seen at night, and the female, being drab or nearly the color of sand, cannot be readily observed on the nest in daytime. The male usually begins to sit three or four days before the hen stops laying. If the weather is cold during the laying period, the male will often be found covering the eggs at intervals during the night to prevent them from becoming chilled. The birds are also very watchful in the warmest season to prevent the eggs from becoming superheated by the sun. The birds do this by resting on their ankle joints and spreading their wings umbrella-wise over the nest. As is usually the case with all eggs in a dry climate, the shell of an ostrich egg becomes dry and hard. It is therefore very difficult for the chick to break through. When the time arrives for the liberation of the young they are heard to chirp and to move in the shell. The parent bird seems to understand the situation, and will often crack the shells with his breastbone, sometimes taking the young by the head and pulling it out of the shell. Sometimes four or five days elapse between the hatching of the first and the last egg. During this time one of the parent birds sticks to the nest while the other takes care of the chicks. However, on a well-regulated ostrich farm the farmer assists the birds in hatching by cracking the eggs with a small hammer and putting the unhatched eggs into an incubator.

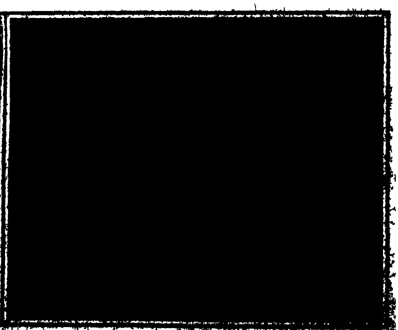
The chicks appear to be all eyes and necks when they first come out of the shells, yet their bodies are as large as those of full-grown hens. They are as fuzzy and as soft as a day-old chicken, but far more stupid. For the first week of their existance nothing but gravel is given the young ostriches. Then they are turned into small pens in the alfalfa lots, where they are to eat alfalfa for the rest of their lives.

Plucking is the general term by which the harvesting of feathers is known. The term might lead one to believe that the feathers are pulled out. This is not the case, however, for that would injure the bird. The plumes are snipped off with shears close to the flesh. The quills that are left soon die and drop out, after which new feathers begin to sprout. There are twenty-five long white plumes on each wing of the cock bird. The rest of the plumage is black on the male and of a grayish color on the female. Gathering the feathers is no easy task. This work has to be done with great care, for a kick from one of the powerful legs of the bird is enough to disable a man for life or even kill him outright.

At the plucking time the birds are driven into individual plucking boxes and a loose bag slipped over their heads, which tends to keep them quiet. A cock bird will roar mournfully while being plucked, although the operation is absolutely painless. After he has been stripped of his plumage he is about as ugly a sight as one could behold.

The first experiment of ostrich farming in this country was made by an Englishman, who imported his birds from Africa and paid as high as $1 200 a pair for them. As in nearly every venture of this character, the originator of the scheme did not make a fortune out of it. But the wise and daring investors who followed in his footsteps are now congratulating themselves. They are reaping the harvest no doubt dreamed of by the starter of the industry in Cali-

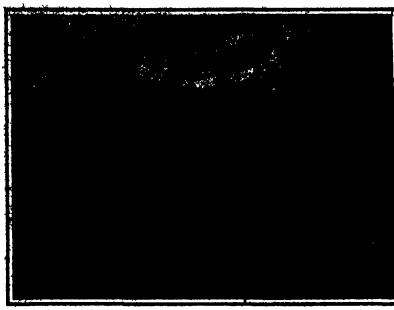
A male chick just hatched by an incubator.



Harvesting the feathers. [illegible]

OSTRICH FARMING AS AN INDUSTRY.

[illegible] It is almost impossible for milliners to meet the demand for high-grade feathers, and if they were dependent solely on the stock imported from Africa, it would be quite out of the question. But so flourishing has become the American ostrich-farming industry that a large part of the supply is now home product. The feathers produced in the United States are just as fine and in some cases much superior to those grown in Africa.



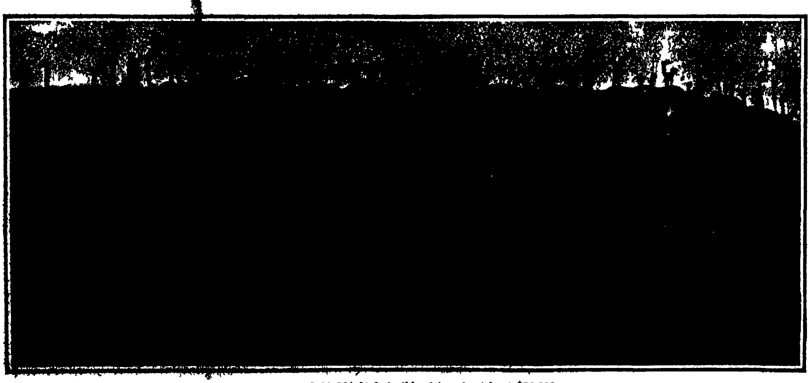
An ostrich-drawn cart.

A pair of birds and their eggs

The business of ostrich farming has long become a science before it was introduced into this country In South Africa there are all manner of laws to protect the business There is a governmental ostrich doctor whose particular duty it is to study the diseases peculiar to such birds There is also an ostrich breeding association where are recorded the pedigrees of the finer birds Some of the farmers have so improved their stock that their ostrich chicks bring from $500 to $1 000 each and many of the most noted cock birds are priced at $7 000

Port Elizabeth in South Africa is the chief ostrich feather port of the world In that vicinity there are nearly a half million birds now in captivity The feathers from these birds sell from $10 to $150 a pound and the industry of this one port alone amounts to some $15 000 000 a year

There are some districts that produce better feathers than others. The Oudtshoorn feather reaches twenty



The value of the 110 birds in this picture is at least $50,000.

OSTRICH FARMING AS AN INDUSTRY

[illegible] inches in length, [illegible]

operation is done by French girls, and the skill with which this work is carried on is marvelous. To each flue on a long plume is tied another in such a way that the joint is invisible Some plumes treated in this manner have been priced at $1 000

Elektron Metal: a New Light Weight Alloy

At the International Aeronautical Exposition in Frankfort a Griesheim firm exhibited a new and patented alloy or series of alloys under the name elektron metal These alloys possess great strength united to exceedingly low specific gravity and hence appear to be the material of the future for various structural purposes Aluminium and its alloys the lightest metals now used in practice, are fifty per cent heavier than elektron metal and far inferior to it in strength and tenacity The new alloys are composed chiefly of magnesium the rather inferior structural qualities of which metal have been very greatly improved by additions of various other metals The alloys vary in specific gravity from 1 75 to 2 0 possess great strength tenacity and elasticity and are easily worked They have a clear metallic ring and when polished a beautiful silvery luster Their resistance to atmospheric influences satisfies every practical requirement, as they become covered with a protective film of oxide when exposed to the air Even in the form of castings they show a tractile strength up to more than 25 000 pounds per square inch and an extensibility up to 5 per cent. By pressing rolling and drawing, the tractile strength can be increased to very nearly 50 000 pounds per square inch and the extensibility to 15 per cent, without producing any appreciable increase in specific gravity The properties of the alloy can be varied within wide limits by varying the nature and proportions of the metals which are added to the magnesium.

The field of usefulness of the new material, therefore, is very extensive Its strength and lightness make it especially valuable for the construction of airships and aeroplanes, but it may also be employed with advantage in the construction of automobiles motors, and machines and instruments of every kind It is so much stronger and lighter than aluminium and its alloys that 60 pounds of it may be substituted for 100 pounds of those materials. For example in a Zeppelin airship having an aluminium frame weighing 12 000 pounds 5 000 pounds weight could be saved without any reduction of strength by the substitution of elektron metal It would then be possible to carry more fuel and ballast increasing the radius of action more passengers or larger and more powerful motors It may even be found possible to diminish the dimensions of the airship and the cost of operating it by an extensive employment of the new material Similar advantages may be expected in automobile construction A large automobile motor for example contains about 450 pounds of aluminium which could be replaced by 275 pounds of elektron metal At the exposition the new material was shown both cast and wrought into a great variety of forms —Umschau

The consumption of pulp wood during 1908 by 251 pulp mills in the United States amounted according to a preliminary report of the Bureau of the Census to 3 346 106 cords of wood which furnished 2 118 947 tons of pulp Nearly 1¼ million cords of domestic and over 670,000 cords of imported spruce were consumed Next in order is domestic hemlock of which 669 173 cords were converted into pulp More than 300 000 cords of poplar were cut last year mostly from domestic timber The remainder of the timber about 19 per cent, was chiefly supplied by pine cottonwood, and balsam

THE HEAVENS IN MARCH

BY HENRY NORRIS RUSSELL, PH.D.

As the year advances, there is a temporary break in the series of cometary phenomena which make the first half of 1910 so noteworthy. Innes's comet, which was so fine an object at the end of January, came almost to rest among the stars early in February, moving almost straight away from the earth and rapidly losing brightness. By this time it is unobservable, behind the sun and some distance north of the ecliptic. In another month or so it should be seen in the morning sky, but only with telescopic aid.

The determination of its orbit has apparently presented unusual difficulties. In order to calculate a comet's orbit, we must first have accurate observations of its position. Such observations are usually made by measuring with the telescope the distance and direction of the comet (or equivalent quantities) from some star whose place in the sky is known from previous observations, taking care to note the time at which these measures were made. In the present case the comet was at first visible only in daylight, when no suitable "comparison stars" could be seen. Its position in the sky had therefore to be found by means of the readings of the graduated circles attached to the telescope, and these are far inferior in accuracy to measures of the former kind.

It is not therefore surprising that the preliminary orbits calculated from these rough observations differ widely among themselves. When the comet reappears in the morning sky, and can be accurately observed, the comparison of the results with the few accurate observations made in January and February will settle the question.

Halley's comet is also out of sight for the present—behind the sun or nearly so and about 175 million miles away. It may still be observed telescopically low in the west in the early evening for a few days early in the month, but it cannot be seen in the morning sky until April is well begun, when it will reappear, much nearer us and probably far brighter than when it vanished in the twilight.

We must therefore for the time being turn our attention mainly to the stars, and among them we will find much to occupy us while we wait for the comet to reappear. Let us begin right overhead with the constellation Gemini. Its two principal stars, Castor and Pollux, identify it at once, for nowhere in our skies are two equally bright stars as near neighbors. The roughly parallel lines of stars which run southwest from these and terminate in the stars γ and η are also easy to identify if once learned.

Castor itself is a fine object with even a small telescope, showing double with a power of fifty diameters. The two components, one about twice as bright as the other, revolve about one another with a period of perhaps 400 years. The faint star which lies about twelve times as far from them as they are from one another is moving with them among the other stars, and is probably also in very slow revolution about them, but, if so, must take more than ten thousand years to complete a single circuit. The star δ is also a fine double. Close by to the eastward is Cancer, with no bright stars but one interesting cluster, visible clearly to the naked eye, and resolved into its separate stars by a field glass. This spot of light, known as Praesepe (the Beehive), is marked on the map.

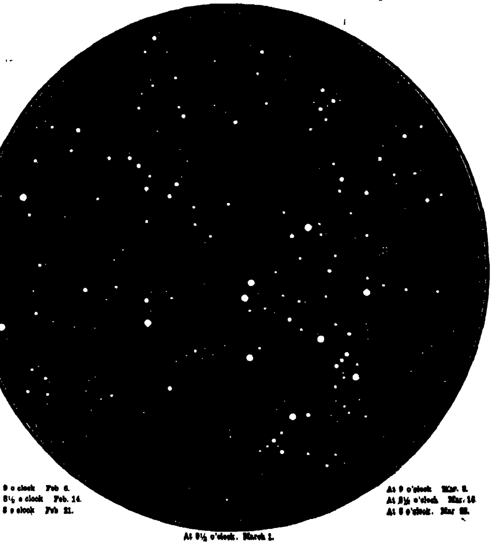
Auriga, which lies in the Milky Way, northwest of the zenith, is one of the finest constellations in the sky. The figure of the charioteer kneeling in his chariot forms our initial letter. The most northerly bright star of the constellation, δ, is in his head, β is in his right arm, and the brilliant yellow star Capella (α) marks the Goat which he is supposed to hold in his left arm, while the three smaller stars just below it are called the kids—an armful indeed! Farther south θ is in his right knee, and ι in his left foot, uncomfortably near the tip of one of the Bull's horns (β Tauri).

Capella is, next to Sirius, the brightest star in the part of the skies which we can see—according to the data of the Nautical Almanac. Arcturus and Vega are however very nearly its equal in brightness, and the three stars differ so widely in color that different observers, whose eyes were unequally sensitive to light of different colors, might easily disagree as to their relative rank. Well down in the west are Orion and his neighbors, Canis Major on the left and Taurus on the right. Mars passes through the latter constellation during the month, and fairly rivals Aldebaran in color and brightness. Perseus and Andromeda are in the northwest—the latter partly set—and Cassiopeia farther to the left.

Due south we see Procyon, with the few faint attendants which are supposed to resemble the Little Dog, high up near the meridian, and part of the great constellation Argo low on the horizon. Farther east, on a level with Procyon, a small but conspicuous group marks the head of the great serpent Hydra, whose body may be followed, past the lonely red star Alphard, down to the southeastern horizon. To the left are Corvus and Crater, and then Virgo, made unusually brilliant by the presence of Jupiter, which is just below the notable double star γ. Higher up is Leo, one of the finer constellations, recognized at once by the "Sickle," at the end of whose handle is the first-magnitude star Regulus.

Farther west, near the horizon, Arcturus shines brilliantly, far surpassing his neighbors in Boötes. Above and on the left is the familiar and gigantic form of the Great Bear. Within the curve of the Bear's tail (the Dipper handle) are the Hunting Dogs which pursue her on an endless chase around the pole. They have but a single bright star, but this is a fine double, worth looking at if one has a telescope magnifying twenty times or more.

The group of small stars known as Berenice's Hair, to the southward, is a good example of a star cluster so coarse that it can be resolved by the naked eye, but yet composed of stars faint enough, and near enough together, to produce almost the impression of a nebula at a hasty glance, while closer scrutiny shows the individual components. Draco, coming up on the right of the pole, Ursa Minor, inclosed within its sweep; and Cepheus, low in the north, complete our survey.



At 9 o'clock Feb 6.
At 8½ o'clock Feb. 14.
At 8 o'clock Feb 21.

At 9½ o'clock. March 1.

At 9 o'clock Mar. 8.
At 8½ o'clock Mar. 16.
At 8 o'clock Mar 23.

NIGHT SKY: FEBRUARY AND MARCH

THE PLANETS.

Mercury is morning star all through March, but, being south of the sun, is not well observable in these latitudes. He may perhaps be seen early in the month, but only with difficulty, as he rises but three-quarters of an hour before the sun.

Venus is likewise a morning star, and, unlike Mercury, is very conspicuous.

She reaches her greatest brightness on the 18th. At this time she appears, with a magnifying power of fifty diameters, just as the crescent moon some five days old does to the naked eye, except that her surface is free from perceptible markings, and uniformly white. She rises about 4 A. M. and is the principal ornament of the morning sky. Indeed, there is no difficulty about seeing her in broad daylight—if the sky is really clear—except that of knowing where to look for her. On the morning of the 16th the crescent moon will be a good guide, as Venus will lie about five or six degrees nearer the sun, and about two degrees above the line joining them.

Mars is still an evening star, but is steadily losing brightness. His distance from us increases from 145 to 170 million miles during the month, and he moves eastward among the stars through Taurus, keeping well ahead of the sun, so that he remains in sight till after 11 P. M.

Jupiter is in opposition on the 31st, and is visible all night long. He is a splendid object to the naked eye, and a fascinating one in even the smallest telescope. His four large satellites can be seen without difficulty, unless indeed some of them should be behind or in front of the planet. In the latter case their shadows can be seen, as black dots on Jupiter's surface, with more powerful instruments, and afford one of the most interesting of celestial spectacles as they transit across his disk.

The elliptical form of the planet due to his rapid rotation, and the dark belts which cross his disk, parallel to his equator, can also be seen with a small instrument. The four other satellites, discovered in recent years, are observable only with a few of the largest telescopes.

Saturn is an evening star, setting about 8 P. M. in the middle of the month. Uranus is in Sagittarius, rising about 3 30 A. M. at the same date. Neptune is well observable in Gemini, his position on the 15th being R. A. 7 h. 11 m. 35 s., Dec. 21 deg. 44 min. north, and his apparent motion very slow. To identify him, however, one needs either a detailed star map or a telescope large enough to show his disk, that is, six inches or so in aperture.

The moon is in her last quarter at 3 A. M. on the 4th, is new at 7 A. M. on the 11th, in her first quarter at 10 P. M. on the 17th, and is full at 3 P. M. on the 25th. She is nearest us on the 12th, and farthest off on the 28th. In her circuit around the sky she passes near Uranus on the 7th, Venus on the 8th, Mercury on the 9th, Saturn on the 13th, Mars on the 16th, Neptune on the 19th, and Jupiter early on the morning of the 26th—only the last conjunction being at all close.

At 7 A. M. on March 21st the sun crosses the celestial equator, passing over the point in the heavens called the vernal equinox, or "first point of Aries," and in almanac language "Spring commences."

Princeton University Observatory.

Gilding Glass or Porcelain.—Prepare a mixture of 900 parts of lavender oil, 100 parts of gold chloride, 5 parts of bismuth subnitrate, and 56 parts of chrome soap. After application, leave the mass to dry and bake the article in a muffle furnace. A brilliant gilding will be produced without further treatment.

THE BULLET'S FLIGHT*

SOME NEWLY DISCOVERED ERRORS IN TARGET SHOOTING

In the face of many excuses, it is a recognized fact that the bullet from a rifle seldom strikes the target where the marksman would like to have it strike. The constant endeavor for years, in all countries, has been to perfect the rifle and reduce its errors at the target. Unlimited time and money have been expended in these efforts. According to the author of the book which lies before us, an author who speaks with a conviction gained from years of patient investigation the innumerable causes of inaccurate rifle shooting, many of which have been known for a long time, may be divided into two great classes first, those inherent in the rifle and its ammunition, and secondly, those which are external to it.

His experimenting and hence his discussion deals exclusively with the errors adherent to the rifle and ammunition, and does not consider any of those belonging to the second class, such as air currents, personal elements of the shooter, humidity of the air, or any error in aiming the rifle. Years of careful machine-rest shooting and the experience of thoughtful riflemen point clearly to the fact that, when all the elements of the second class are excluded, the rifle and its ammunition produce a regular and ever-present error at the target which has not yet been overcome. To determine the nature of that error is the author's primary purpose.

The cause of this ever spreading of shots he has experimentally disclosed, with the result that the rifleman knows better than he ever did before, the defects of rifle and bullets. The book teaches us how to eliminate the errors of the rifle and its ammunition, and to know which elements of the cause for such errors cannot be overcome by human skill, thus allowing us to proceed intelligently rather than under old methods of guesswork experiments.

The method and apparatus to bring out these hitherto undiscovered errors are fully set forth, illustrated, and explained. The system of investigation adopted was based on the principle of exclusion, that is, the personal element, movement of the air, mirage, and faulty aiming were eliminated. Covering as it does the work of years, the book is commendably exhaustive.

During 1901 a suitable machine rest, differing materially from anything before produced, was made as here illustrated (Fig 1). It was built of concrete, and was permanently rigid. Upon it a bronze V three feet long was securely bolted. The barrel of the rifle, stripped of its normal action and wooden stock, was mounted in aluminium rings, one for the muzzle and one at breech, and, thus surrounded, was held in its normal position in the bronze V, which was accurately machined. A concentric action, as shown by illustration (Fig. 2), took the place of the normal rifle action, completing this part of the outfit. The line of fire remained the same from day to day and from year to year.

Between the rifle's muzzle and target, paper screens were placed, through which the bullet passed in its flight. A perpendicular line through the center of each screen, by the aid of telescope and cross hairs, was brought into exact line of the V rest, which was also the line of fire of the rifle barrel which lay upon it. This arrangement of lines and screens enabled the author to follow the course of each bullet, and the screens were spaced at distances along the range to match the experiment in hand. A distance of three feet apart was sufficient for testing some of the curves which the bullet made, but in many experiments it was found necessary to place the screens from six to three inches apart to register the bullet's motion. Day by day facts were accumulated, and at the end of several years the author could so place these screens that any desired information respecting the bullet's motions could be expeditiously obtained, one irregularity after another being eliminated to that end.

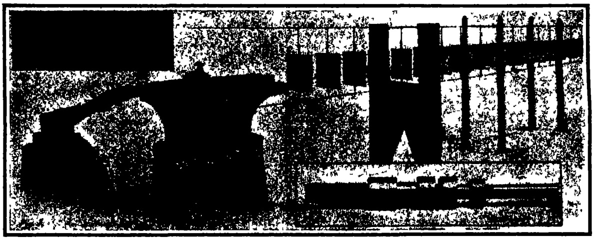


Fig. 1.—The rest and the screens. Fig. 2.—Concentric action. Fig 3.—How the center of gravity of an unbalanced bullet moves in a spiral form and how when liberated at the muzzle, it takes a straight flight as represented by the tangent a.

Machine rest target shooting to detect errors in rifle and bullet.

As is often found to be the case in all scientific experiments, preconceived ideas of the bullet's action proved to be more or less incorrect, and the strongest fixed idea of all, the one to which it seemed all conclusions must be made to bend, was found to be absolutely incorrect. This idea, that the bullet during its passage through the rifle must and did fly in a straight line with the bore, and that afterward it changed its direction to fly away from the mark, held the author back from the real fact for years. Screens placed at one, two, or three feet from the muzzle showed indisputably that an unbalanced bullet left the line of fire, or line of the bore, immediately upon its exit therefrom, and the cause of this was a very astounding discovery to make.

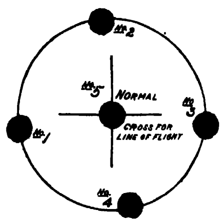
It is easily understood that the center of gravity of an unbalanced bullet is not in its center of form, and therefore not in center of the rifle bore. Due to the twist in all modern rifles, this unbalanced bullet rotates during its passage to the muzzle and carries its center of gravity in a spiral around the straight line forming the center of the bore, and also carries its center of gravity around the center of form of the bullet itself. In mechanics and especially in ballistics the course through which a body moves is the line in which its center of gravity travels. Hence the unbalanced bullet (all bullets being more or less unbalanced) travels in a spiral through the straight rifled bore, compelled to take this spiral course by the solid walls formed by the internal surface of the barrel.

When the projectile is liberated at the muzzle, no longer forced to make a spiral flight, it immediately takes up a straight flight, which it must do according to the fixed laws of inertia. This straight line, however is a continuation of the flight which the bullet was making as it left the muzzle not the line of bore, but a tangent to the spiral which the projectile described in the bore as represented though grossly exaggerated, by the spiral *s s* and its tangent *a* or *c c* in Fig 3.

Fig 3 exaggerates and makes clear how the center of gravity of an unbalanced bullet moves in a spiral form within the bore, but how when liberated at the muzzle, it takes a straight flight, as represented by the tangent at the right extremity of the spiral in the direction of *a*. No possible power at the muzzle could make it take the direction of bore as represented by *d d*, without disintegrating the bullet. Thus the bullet, instead of flying straight in the rifle bore as every one supposed, and making some change in its direction afterward, in reality flies in a spiral during its passage to the muzzle, and does not change its direction at the muzzle, because there is nothing there so to change it. This is the long-searched for cause of error at the target.

The presence of this error, called the "Y error" by the author, was clearly demonstrated in screen shooting by E A Leopold of Norristown, Pa a number of years ago, and the apparent change of direction in the flight of a bullet at the muzzle was known in an indefinite manner to various riflemen. Their attempts to overcome it, and the theory upon which these attempts were

(Continued on page 210.)

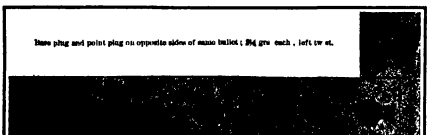


Only one bullet hit the mark (center) although all were fired under exactly the same conditions. The picture shows the X error at 16 feet from the muzzle

Fig. 4.—Five bullets fired from a fixed rest.

This took the place of the normal rifle action, the line of fire remaining the same year in and year out.

Fig. 5.—Elements of the concentric action shown in Fig 2.



From the cross at upper left corner where a true bullet points to numbers 1 and 2 bullet holes is 4¼ inches and is the Y error at 100 yards. The seven screens at distances from the muzzle show that No. 2 shot had no X error. A like set of screens also showed that shot No. 1 had no X error. This illustration shows the error resulting from a tipping bullet.

Fig. 6.—Y-error at 100 yds. Illustrated by actual target made by two unbalanced bullets.

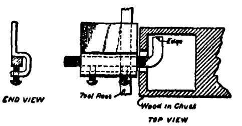
THE BULLET'S FLIGHT.—SOME NEWLY DISCOVERED ERRORS IN TARGET SHOOTING.

* The Bullet's Flight from Powder to Target. The internal and external ballistics of small arms. A study of rifle shooting with the personal element excluded, disclosing the cause of the error at the target. Illustrated with 188 plates, showing the results of over 800 rifle experiments performed and chronologically arranged. By F. W. Mann, B.S., M.D. Size 6¼ x 9¼ inches. 384 pages. [illegible] New York, 1909. Munn [illegible]

TOOL-HOLDING DEVICE FOR WOOD TURNING

BY CHAUNCEY W. NIEMAN

Those who use a wood lathe find frequent occasion to make special tools for difficult or unusual work, and when the tool is so shaped that the cutting edge is at right angles to the shank, great annoyance is experienced in holding the tool to the work, and keeping it from turning in the hand Recently I had



TOOL-HOLDING DEVICE FOR WOOD TURNING

a piece of work similar to that shown in the drawing and after many expedients had failed to give complete satisfaction I developed the device illustrated It is made of heavy sheet steel (the heaviest I could work easily) and provided with two set-screws, as shown, to allow it to be moved along the chisel as desired, and for the insertion of new chisels As illustrated, the flat portion lies on the tool rest, and this absolutely prevents the turning of the tool By its use I was able to reach with ease the most inaccessible corners.

ELECTRIC INCUBATORS AND BROODERS

BY FREDERICK E. WARD

The advantages of an electrically heated incubator over those making use of kerosene lamps and the like are so great, that as rapidly as cheap reliable power service becomes extended throughout the country, the hatching of eggs by electricity bids fair to displace all other methods.

An electric incubator can be built at home by anybody who can make a wooden box and connect up ordinary incandescent lamps. Such a machine has not only the merit of being low in first cost, but of having nothing about it to wear out, and of being capable of giving perfect results with very little attention on the part of the operator

The photographs show the first incubator built by the author, while the drawings give details of construction drawn to scale, for a similar machine of fifty eggs capacity Briefly it consists of an outer and an inner wooden box, having the space between them packed with wool or other heat retaining material The eggs are placed in the inner box, which is warmed with incandescent lamps controlled by a thermostat

The boxes should be made of well-seasoned lumber about ½ inch thick Old soap boxes furnish good material for the purpose For a fifty-egg machine the inner box needs to be 11 inches wide, 17 inches long, and 11 inches deep, all inside measurements This box is to be left without any top or bottom except a slatted bottom which is to be put in half way down thus dividing the box into an upper and a lower compartment of equal depth On top of the slats a double thickness of woolen blanket should be tacked, to support the eggs, as shown in Fig 1

Eight electric lamps are required for the heating units These are best mounted in porcelain receptacles as shown, four lamps in each compartment near its top For 110-volt circuits use ordinary 16-candle-power carbon filament lamps made for 230 volts, and connect them as shown in the diagram, where *REG* means regulator, or thermostat and *SS* are snap switches to be placed on the outside, as shown in one of the photographs.

It is hardly worth while to make a thermostat at home when one suitable for the purpose can be bought from a dealer in electrical supplies for about seventy-five cents, but it is not a difficult job for anybody who takes pleasure in doing such work Fig. 2 shows a simple form of thermostat attached directly to the inside of the egg chamber The essential part consists of two strips of metal riveted together as shown in the top view at *A* Zinc and steel (or iron) make the most effective combination, brass and steel (or iron) come next The strips should be about 1/32 inch thick, 8 inches long, 1 inch wide at the large end and 3/8 inch at the narrow end They may be fastened together with fifteen or twenty small rivets, or by soldering them all around the edges The two metals thus joined tend to curl and uncurl with changes in temperature, by reason of their different rates of expansion The large end should be clamped to a block, *B*, as shown, and a contact screw should be provided at *C*, with a stiff wire, *D*, attached to serve as a screwdriver for adjustment from the outside It is highly important that the tip of the screw *C* and the spot on the zinc (or brass) strip be protected by pieces of platinum soldered on, or the electric arc which appears between them will soon destroy them If the thermostat be purchased as advised, it must be mounted in such a position that the adjusting screw can be reached by a screwdriver or wire passing in from the outside through small holes in the boxes.

The inner and outer boxes are to be joined at the bottom by a passageway or tunnel three inches high, forming a doorway through which chicks may enter the brooding compartment under the egg chamber The inner and outer boxes are to be joined near the top by three or four half inch tubes for ventilation as shown at *V*, Fig 2

The top of the egg chamber is best covered over with a pane of glass, on top of which is laid a small pillow or several thicknesses of folded blanket.

Next in importance to the thermostat comes the choice of a thermometer and its proper location in

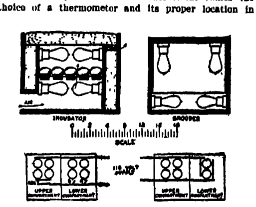


Fig 1.—CONSTRUCTIONAL DETAILS AND WIRING DIAGRAM OF THE INCUBATOR AND BROODER.

the egg chamber, where the bulb should occupy a central position rather than one near a corner It is not necessary to buy an expensive instrument in order to get accuracy, an ordinary ten-cent thermometer can be made to serve the purpose very well provided that its scale be properly corrected or "calibrated" This may be easily accomplished by taking advantage of the fact that the internal temperature of a normal, healthy person is just a trifle over 98 deg Tie a thread around the tube at the place marked 98 deg on the scale, and remove the tube from the scale, to which it is usually attached by two bits of wire. Place the bulb under the tongue at the side of the mouth and hold it until the mercury column does not rise any higher By observing with a mirror it will then be possible to determine quite accurately how much in error the marking on the scale may be, and due allowance for this can then be made by assuming that the same error is present at the 104-deg. mark, which is the temperature of incubation.

The machine must be run a few days before any eggs are put in, to give time for carefully adjusting the thermostat When the latter is once set right it will automatically maintain the heat at the desired point by "winking" the lamps on and off. With all eight lamps in use, the apparatus as described is capable of maintaining a temperature of 104 deg. in the egg chamber when the room temperature is only 40 deg. If used in a warmer room, one pair of the lamps in the lower compartment may be turned off by means of the snap switch

Each pair of 230-volt 16-candle-power carbon lamps, connected in series as shown, will, when used on a 110-volt circuit, burn with a dull red glow scarcely visible in daylight, and with a power consumption of 5½ watts. A fifty-egg machine operated in a room where the temperature is 65 deg. consumes about 16 watts, making a total for 22 days of about 8 kilowatt hours, which, where the rate is 10 cents, costs 80 cents. This cost looks high at first sight, but it is materially lower than that of a kerosene-burning machine if one stops to consider the saving in interest on first investment,

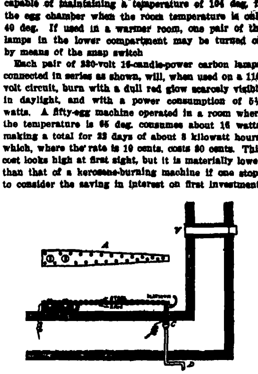


Fig 2.—METHOD OF APPLYING THE THERMOSTAT.

the saving in oil, the absence of depreciation and repair bills, and the saving in labor of attendance.

In the practical operation of the incubator, the following points should be borne in mind

The eggs need to be turned partly over every day A good way to do this is to take out the row of five eggs at the left hand end, roll the remaining ones toward the left, and replace the five at the right-hand end This progressive movement serves also to even up the different times of hatching that might result from some eggs remaining in warmer spots than others

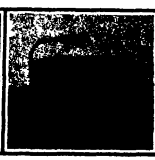
Increasing ventilation is required as incubation progresses Practically no air is needed the first two weeks, and all ventilating tubes and the door to the lower compartment may be kept closed with considerable economy in power During the third week, and especially when the hatch is due, plenty of air must be allowed to filter up through the eggs, as shown by the arrows in Fig 1

No moisture is required during the first week Thereafter it is best to keep a small pan of water in the lower compartment and a small glassful in the egg chamber These serve to prevent excessive evaporation of the eggs by too dry air

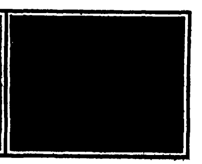
The newly hatched chicks should not be taken out or fed until they are 24 hours old After this they may be kept in the lower compartment for a time, provided all four lamps be kept burning. As soon as convenient, however, they should be transferred to an electric brooder, two forms of which will now be described

The first and simpler form, suitable for use only in a well warmed room, is shown in one of the photographs. It consists of a small wooden table carrying on its under side four lamps, and surrounded by a fringe made by slitting a piece of old blanket. For use on the ground or where the floor is not warm, bottom heat must be provided as shown in Fig. 1 Forty chicks can be accommodated by such a brooder having the following dimensions Top, 14 by 20 inches, supported by legs 8 inches long. Bottom box of wood, 14 by 20 inches outside, 2 inches deep inside. Box-cover of tin 14 by 20 inches, protected on top by a sheet of paper and a sprinkling of sand Four lamps are required in the upper part, one near each corner, and two in the bottom heater It will be observed in the diagram of connections that the latter lamps are connected in parallel and not in series, which causes them to burn more brightly The power consumption is 33 watts, or about twice what is required for hatching. No thermostat or thermometer is needed for the brooder It will not get too warm if the current is left on all the time.

THE BROODER WITHOUT BOTTOM HEATER.



INCUBATOR WITH BROODING COMPARTMENT OPEN.



PLAN VIEW WITH COVER REMOVED.

Where any form of [illegible] described, is used it to [illegible] with the floor or, to [illegible]

of which the chicks may get up on the raised platform.

The following bill gives a list of all materials needed and their present retail prices.

For the Incubator

8 220-volt 16-candle-power carbon lamps	$1.60
8 porcelain receptacles	.48
1 thermostat	75
1 thermometer	.10
2 single-pole snap switches	.30
1 piece 13 x 18 window glass	.20
Lumber, etc.	.15
Total	$3.58

For the Brooder.

6 220-volt 16-candle-power carbon lamps	$1.20
6 porcelain receptacles	.36
1 sheet 14 x 20 tin	.15
Lumber, etc.	05
Total	$1 76

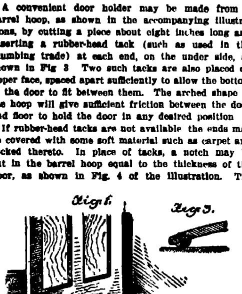
The foregoing bill does not include the shaded lamp and fixtures shown on the outside of the incubator in Figs. 1 and 2. An ordinary 4-candle-power lamp so mounted is a convenience, but not in any way essential.

CONVENIENT DOOR HOLDER.

BY D. PENNINGTON

A convenient door holder may be made from a barrel hoop, as shown in the accompanying illustrations, by cutting a piece about eight inches long and inserting a rubber-head tack (such as used in the plumbing trade) at each end, on the under side, as shown in Fig 3. Two such tacks are also placed on upper face, spaced apart sufficiently to allow the bottom of the door to fit between them. The arched shape of the hoop will give sufficient friction between the door and floor to hold the door in any desired position.

If rubber-head tacks are not available the ends may be covered with some soft material such as carpet and tacked thereto. In place of tacks, a notch may be cut in the barrel hoop equal to the thickness of the door, as shown in Fig. 4 of the illustration. The



HOME-MADE DOOR-SECURING DEVICE.

center of a barrel stave may be used instead of a hoop by cutting it to about the same width as the hoop.

BORING HOLES IN GLASS.

BY GEORGE J MURDOCK.

Glass is universally conceded to be exceedingly difficult to work when cold, yet its fragile nature often calls for means of repair. It is also desirable sometimes to drill large holes in glass plate, or through a glass column, which is not an easy thing to do with any facilities hitherto developed for such work.

It is well known that turpentine applied to a small drill will enable one to drill through a piece of glass by persistent application and frequent grindings of the drill. This hole will often taper from a larger diameter at the top to a smaller one at the bottom, and besides it is quite impossible to drill two holes of the same size with the same drill. Instrument work of certain classes would be made better also if it were possible to tap threads in the glass of which the base or other parts are composed. In the opinion of the writer the best fluid to be applied to the glass so that the tool will take hold is that of the formula given below. It has been developed after many experiments with different mixtures, and will be found to be superior to anything heretofore known. With a bastard file wet with it, a piece of plate glass may be put into a vise and filed like wood; any other cut of file may be used, but where there is much glass to remove, the coarser the file the better.

For drilling small holes, a brass tube of the diameter of the hole wished is better than a drill. The tube should be made smooth on the end that is to come in contact with the glass, and charged with carborundum powder, or what is better, diamond dust. In making the hole a piece of wood having a hole drilled in it of the size of the brass tube should be cemented to the glass, the hole being located over the spot where the desired hole is to be made. A hole should be made in the side of the tube by filing into it with a round file, and it may be turned either by a drill press or by one of the small, geared, hand drill-stocks used for small drills. With a small brush dipped into the solution as herein given wipe the hole so that a little of the mixture will run down inside the tube, and onto the glass where the hole is being made, and the tube will be found to enter the glass with surprising ease.

If it is desired to have the edge of the hole sharp where the tube comes through, cement a small piece of

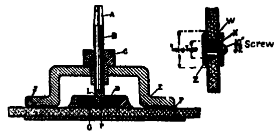


Fig. 1.—APPARATUS FOR BORING LARGE HOLES IN GLASS. Fig 2.—METHOD OF REPAIRING CRACKED PLATE GLASS.

glass to the under side of the plate being bored, and when the tube is through, continue the boring until it has entered the lower plate slightly. Glass cut with the diamond will often break unevenly, and fail to fit a window sash, circles cut out for the dials of instruments of the clock class, circles for static electric machines, glass covers for galvanometers, ammeters, and many other instruments are often thrown away, when a touch with a file wet with this solution would save them. It is especially recommended to glaziers to remove the sharp edges of the glass cut with the diamond, which often cut the hands. For boring large holes in plate glass the jig shown in the sectional view, Fig 1, is very handy, in fact almost essential if correct results are required. It can be easily modified to hold the cutter for boring circular work, such as glass columns or concave surfaces, where circumstances require such variation. The frame is an iron casting having feet J, and is bored out to receive a steel bushing C, which may be hardened after a central hole is made to receive the shank B of the cutter bar. The top of the cutter bar or shaft is squared at A so that a bit stock may hold it, or it may be held by the chuck of a drill press. The bottom has a flange and a pilot L, which fits in the hole of a small emery wheel G of the kind used by toolmakers on universal grinding machines for lapping out small holes.

The lead bushing in the wheel should be cut out on the side that is to do the boring, and the pilot L must not go entirely through the wheel, but be cut at least ¼ of an inch short of the wheel thickness. The wheel may now be cemented to the cutter shaft by heating it, and also the wheel slightly, so as to melt some gum shellac which has been sprinkled on the top side of the wheel. After it is cold mix up a stiff paste of liquid glue and emery of about the same grade as the wheel, and fill the bottom of the hole P even with the wheel. In drying it will shrink slightly and the paste may be applied again, and until the surface is flush with the side of the wheel.

The feet J of the frame have thin rubber F (known in the stores as "rubber dam") cemented to their under sides with bicycle tire cement, so that when placed on the glass the jig will not slip around, but can be easily held in any desired location.

The place where the hole is to be made having been ascertained, a ring of putty D is stuck to the glass to form a cup, and after the wheel shaft is inserted in the bushing, the apparatus is placed with the face of the wheel over the spot to be bored, with the feet J resting on the glass. Before beginning operations a piece of double-thick window glass H is cemented with French copal varnish to the under side of the plate to be bored.

The formula for the fluid to be applied to the tools is as follows:

Pulverized camphor	oz. ii
Sulphuric ether	dr vi

Enough oil turpentine to make a six-ounce bottle full.

Apply the bit stock to the shank A of the shaft, then pour enough of the fluid into the putty cup to cover the lower side of the wheel G.

When the wheel is turned it will immediately enter the glass, boring a very smooth and true hole. If a drill press is used, the speed should be slow to avoid throwing the fluid out of the cup or heating the wheel, the last being especially avoided, as all of the constituents of the fluid are very volatile, and it will evaporate quickly if much heat is present.

When the hole is nearly through moderate the pressure, but keep on drilling until the wheel has entered the plate H slightly. A slight tap with a hammer will now knock the window glass off, and the wheel and shaft may be removed through the hole. Do not attempt to remove it through the top unless the hole is very clean, or you will pull the wheel off the arbor.

Fig 2 shows how a cracked plate-glass window may be repaired. At the ends of each crack and where they intersect a hole is bored to receive a bolt. The nut Z of the bolt is made thin, and a rubber washer, made of engine packing is held against the glass by a washer and screw. The dimensions given are those used some time ago in repairing a store window. The heads of the screws were located inside the store, so as to make it impossible to remove them from the outside. The window is still doing service.

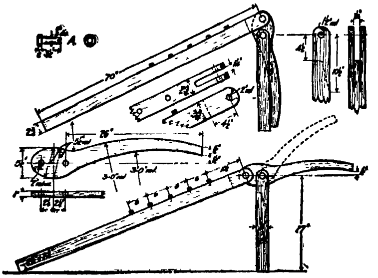
A WAGON JACK.

BY I. G. BAYLEY

For oiling wagon wheels, or taking them off, some kind of lifting arrangement is resorted to. For simplicity of construction and effectiveness the jack herewith described is unique. The whole, including the pegs or pins A, is made of oak, the best tough white oak being recommended.

The beam is made from 3 by 4 inch timber, planed down to the dimensions given. An eye or slot is cut out at the wide end 1 1/16 inches wide by 4½ inches deep. This end is rounded off to a radius of 2 inches. Five pegs, 1 inch diameter by 2 inches in length, are driven into the upper side. The holes are 1 inch deep and should allow the pegs to have a driving fit.

The upright is 27 inches high to the center of the



A WAGON JACK.

fulcrum, made from 3- by 4-inch stuff. The end is rounded off to a radius of 1½ inches, and a slotted hole is cut in, as indicated in the detail view.

The lever is cut from 1 inch board, 6 inches wide by about 33 or 34 inches in length. It should be laid out accurately to the dimensions given in the larger scale view. When correctly made and the slot in the upright cut likewise the two holes for the pegs A will be in a vertical line, when the lever is pressed down, as shown in the upper general view. The pegs A should have a loose fit, and be furnished with small wooden pegs or nails, to keep them in place, when the parts are assembled.

To operate the jack the lever is raised as shown in dotted lines in the lower general sketch and the beam slipped in place under the axle of the wagon, which should rest between one of the small pegs in the upper face. Bearing on the lever it is pressed down into its lowest position, as shown in the upper sketch, raising the wagon wheel from the ground and securing it in that position indefinitely, without the least chance of its slipping back.

Swelling ground cannot be held by timber, means must be provided for relieving the pressure of the ground from time to time. It will cause little trouble if spaces are left between the lagging, through which the pressure may be eased at intervals by removing some of the material. Expedients such as packing with straw are valuable only until the swelling becomes sufficient to pack tightly the cushioning substance. When this becomes packed solidly it transmits the pressure to the timbers.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

TIE-CLASP.—A. M. BANTA, New York, N. Y. In this case the invention relates to tie clasps such as are attached to four-in-hand ties to secure them to the shirt front. The object of the improvement is to produce a tie-clasp which can be very simply constructed, readily applied and effective in holding the tie in position.

Electrical Devices.

SYSTEM OF INSULATION.—J. STEINBERGER, New York, N. Y. Mr. Steinberger's invention relates to systems of insulation for high potential electric conductors to be used in various relations and for various purposes such as power transmission, and for guy wires or cables employed as stays, towers, or for poles, masts, and other supports used in wireless telegraphy, as well as in ordinary commercial work.

CIGAR MOISTENER.—I. C. TEPUHROW, St. Joseph, Mo. In the present patent the invention has for its object the provision of a device to be used in show cases (where the lamp or coil used is connected with a source of electric current) which will vaporize a sufficient quantity of water to keep the atmosphere of the case moist so as to prevent the drying out of cigars placed therein.

Of Interest to Farmers.

PLOW.—J. G. REDMOND, Fairmount, Ill. The intention here is to provide means for lifting the plow cylinder from the ground as when taking the machine to and from the field, this means being preferably constituted by crank arms attached at opposite ends of the plow axle, each having a wheel journaled at its outer end with one of the arms provided with an operating lever and means for positively driving the wheels from the plow.

FRAME FOR MANURE SPREADERS.—F. SCHAAL, New Staphhurst, Neb. The frame is adapted to be attached to a wagon or cart body so as to adapt the same to be used as a manure spreader. The object of the invention is to produce a frame which can be readily attached to the box or body of the cart or wagon and which will be constructed in such a way as to facilitate the removal of the manure from the rear end.

DEVICE FOR DISPENSING TRAVELERS.—J. S. DRAKE, Lancaster, S. C. In spinning cotton the travelers after a few days' use wear out and are replaced. A great amount of time is lost in endeavoring to loosen a single traveler from the entangled mass and the result is a loss to the mill as about four travelers are purchased for one actually used. This invention provides a dispenser which delivers one traveler at a time, which avoids unnecessary waste, and saves considerable time.

Of General Interest.

CIGAR BUTT FORMER.—J. CARTER, New York, N. Y. The aim in this case is to provide certain improvements in the formation of the butt end of cigars whereby convenient and accurate folding and fixing of the wrapper to the butt end of a cigar is obtained without resort to the expensive manual operation of cutting, shaping and pasting.

DOOR LOCK AND SWITCH.—F. F. SALIHORE, New York, N. Y. The purpose here is to provide for elevators a door lock and switch, arranged to prevent the shaft door from being opened at the time the car is not at the landing, and to prevent the car from being moved away from the landing, either in its ascent or descent, until the door is again locked.

DISPLAY STAND.—H. ROSENTHAL, Yonkers, N. Y. This stand is intended for use in displaying confectionery, cigars and the like. One object is to provide a transparent protective closure which may be readily applied to a box containing confectionery, cigars and similar articles of merchandise in order to protect the same from moisture, dirt, etc.

INSECT CATCHER.—A. H. LEE, Canby, Ore. In this construction the inventor employs a fruit partially decayed as a bait and utilizes the container of poisonous or destroying liquid as the cover or top for the fruit container. In connection with these containers he preferably employs a light suspended with its lower portion adjacent the surface of the liquid so as to attract the insects at night.

DESK ATTACHMENT.—J. A. SMYLIE and G. D. MCELWAE, Centerville, Miss. This device will facilitate the handling of books in office work and consists of a carriage wherein novel features of adjusting and controlling the travel of the same are made use of, permitting the carriages to travel in any inclined plane without the use of a track or guard.

MAGAZINE BINDER.—J. POHORALEK, New York, N. Y. This binder is of book form having a number of leaf retaining bars at the back extending longitudinally and provided with cross-pins, each bar engaging a pin by an endwise movement on the other pin by a lateral movement, and casings extending over the opposite end portions of the pins, with the casing of the pin engaged by a lateral movement of the bars movably mounted to pass into and out of overlapping relation to the latter, whereby the bars are locked and unlocked.

ROAD-GRADER.—J. P. LUTES, Buffalo, Mo. The invention is an improvement in road graders or drags and has in view a device of this character in which each scraper takes care of its own dirt from the time it leaves the ditch until it is discharged at the center of the grade, thus avoiding the danger of clogging and making the device easy of operation and light of draft.

Hardware and Tools.

RIVETING DEVICE.—J. TISCHLER, East Portchester, Conn. The invention pertains to certain improvements in riveting devices and involves a clamp so constructed that it may engage with the head of a rivet to hold the latter in place and at the same time, to leave the opposite end of the rivet exposed so that it may be pounded or beaten into the form of a second head.

UNDERCUTTER SUPPORT.—W. J. WHITWORTH, North Bend, Ore. This invention refers to supports for saws and particularly to the means of adjusting the supporting-arm, and to the means of adjusting the holding dog. Means provide for adjusting the supporting-arm relative to the holding-dog, and for adjusting the holding dog relatively to the other parts.

RAKE FOR ROTARY LAWN-CLEANERS.—C. H. MOSHER, Salisbury Mills, N. Y. The invention relates to cleaners such as the one formerly patented to Mr. Mosher. The object is to produce a rake in which the teeth are separately attached, and in which the teeth are arranged in rows or phalanxes, the individuals of each row being advanced progressively with respect to each other.

SEAL LOCK FOR RECEPTACLES.—C. H. JOHNSON, Petaluma, Cal. The invention refers to attachments for signature seals for safety boxes and the like. It also has reference to safety boxes in which a number of persons have separate keys for separate locking openings in the same box and in which a plurality of signature seals are used to cover the locking openings.

DOOR LOCK.—L. F. ROBERTS, Howard, Kan. The object here is to provide a lock of the combination type. It embodies details that adapt the lock for service as a door latch that may be freely operated by means of a knob on the inner side of the door but which will require manipulation of latch controlling disks set to a certain combination for release of the latch bolt from the exterior of the door.

NUT LOCK.—C. F. DAVIDSON and B. I. MAULDIN, Ozona, Texas. The invention is an improvement in nut locks and has for an object to provide a construction affording a pawl-like device carried in the body of the nut and adapted to bed itself in the bolt threads or seat in grooves or channels formed therein.

RATCHET WRENCH.—W. COOK, Phillipsburg, N. J. This wrench has a ratchet wheel presenting a socket which may be applied to the head of a nut or bolt for rotating the same. This wheel is mounted in a ratchet head and is adapted to be advanced by means of a lever operating through a pawl. The socket is constructed in such a way as to enable it to retain inset jaws which reduce the size of the socket or enable it to be used as a pipe wrench.

Heating and Lighting.

INVERTED INCANDESCENT GAS LAMP.—G. RAAP, 30a Blumenstrasse, Berlin, Germany. This invention has for its object an incandescent gas burner in which by making the metal walls of the burner head and of the mixing tube of appropriate thickness and if desired in combination with means for conducting away the heat, a regulation of the heating effect is obtained.

Household Utilities.

AUXILIARY WATER-CLOSET SEAT.—J. G. STEPFER, New York, N. Y. This invention provides an auxiliary seat for the use of small children in connection with the regular seat of a water-closet, privy, hospital commode or other night soil receptacle, the auxiliary seat being so designed that it affords the maximum convenience and comfort and so that it can be placed upon the regular seat board used by adults and firmly maintained in position.

CURTAIN-POLE BRACKET.—B. LUTTICH, New York, N. Y. In the present patent the invention has reference to brackets such as used for supporting curtain-poles. The object of the inventor is to produce a bracket of simple construction which can be readily attached to a window casement and which will afford support for a curtain pole.

MATCH RECEPTACLE.—H. WARK, New York, N. Y. The object in this instance is to provide a match receptacle to be employed with safety matches or with ordinary matches, from which the matches can be taken one at a time without difficulty, which can be easily and expeditiously filled with matches, and which is neat and attractive in appearance.

SHUTTER AND VENTILATOR.—W. P. RYLANDER, San Marcos, Texas. In this instance the invention pertains to improvements in shutters of the slatted type and has for its object to provide a shutter which may be used for ventilation alone, for ventilation and at the same time securing privacy, and finally to produce a shutter which may be so adjusted as to be practically a solid blind.

TEA AND COFFEE SAVER.—E. F. CONSERT, New York, N. Y. The more particular purpose in this patent is to provide a cage movably mounted within a pot and adapted to be raised and lowered in order to expose the tea or coffee to the liquid. Means provide for holding the cage in a plurality of different positions, so that the cage and its contents may be in one instance completely submerged and in another completely raised out of the liquid.

Machines and Mechanical Devices.

LIFTING JACK.—G. R. BOOTH, Chana, Ill. The improvement has reference to lifting jacks, and has for its object to provide one with all the parts so proportioned and disposed that it is compact, strong, while of light construction, easy to operate and the parts of which, when at rest, will rattle very little, if at all.

VENDING MACHINE.—W. ASBURY, New York, N. Y. An object here is to provide a machine with mechanism by the means of which a practical two-coin machine is produced. Another object is to provide means by which a coin will bring a lever into operative position to be actuated by an arm secured to a shaft by the means of which the ejecting mechanism may be actuated.

APPARATUS FOR THE PURIFICATION OF WATER.—J. P. LAJOIE, Taverny, Avenue De Larivière, Seine, France. The invention relates to mechanism for purifying water used for various purposes, and especially for manufacturing, the more particular purpose being to rid water of calcareous matter and various salts which might otherwise coat the interior of boilers. A few moments of each week of an operator's time is sufficient to keep the apparatus in constant operation.

MULTIPLE SELF-INKING STAMP HOLDER.—V. W. HOLMES, Fort Thomas, Ky. More particularly the invention relates to improvements whereby any one of a series of stamps carried by the holder may be brought into operative position in respect to the inking device and, at the same time be in proper position for application to the surface to be stamped.

SHAPER ATTACHMENT.—I. KRAMER and C. BROWN, Evansville, Ind. By means of the attachment material may be turned into various shapes by adjustment of different forms to the machine, the forms being secured to the shaft in which the material is secured for rotation, and the forms acting on the knives to produce the desired result. Means permit the gradual movement of the material to be treated, against the knives and to hold it yieldingly in this direction.

PAPER FOLDING MACHINE.—A. B. COLLOM, L. F. MCCLINTOCK, W. C. STEWART and R. R. MCCREIGHT, Marion, Ill. The machine is particularly designed to prepare by folding or doubling the tie sack and pouch labels used by postal and post office clerks. The machine will fold the slips and print the name and date thereon, and deliver the folded labels in order to a receiving box. A novel feeding mechanism is also provided for automatic action.

UNIVERSAL CONTROLLING VALVE.—W. C. ARL, F. F. HILDRETH and F. N. RUMBLEY, Terre Haute, Ind. This invention relates to valves for controlling the operations of mechanism which are actuated by compressed air, steam or vapors under pressure. An object is to provide a device in which by the simple manipulation of an operating handle the control of the various pipes and cylinders in an air brake system is effective.

STENCIL MACHINE.—R. C. WIGHT, Richmond, Va. This invention is more particularly designed for use in places where a number of packages or articles have to be impressed with the same name and address, although it may be conveniently used when only one name and address is to be impressed. The main object is to provide a device in which a name can be quickly set up and then impressed upon the article at one operation.

BELT RACK.—R. L. SMITH, Lincoln, Neb. The rack occupies little room and carries many belts which may be readily moved to the desired position to permit of their being unrolled. Another object is to so construct the device that the belting will be prevented from slipping from the spindles by the frame of the device, it being possible to move the spindles to a position at which the belts can be readily moved.

MIXING MACHINE FOR FERTILIZERS OR CEMENTS.—C. R. HEMRICK, Atlanta, Ga. The machine comprises a crusher which is employed in connection with one of the hoppers, which enables one of the ingredients to be crushed as the mixing takes place. The construction involves a tumbling barrel which receives the ingredients to be mixed and this barrel is rotated continuously in an inclined position so as to bring about a thorough mixture of the different ingredients.

BRAKE FOR ELEVATORS.—W. R. ELLIOTT, Somerset, Ky. Means are here provided whereby the action of the car can be controlled in the ordinary operation, means whereby the car may be automatically arrested in the event of its starting to fall, means whereby a car may be held immovably in any arrested position, and to simplify the construction and arrangement of the parts constituting the brake, and to decrease the cost of the device.

BELT FASTENER.—C. O. L. CARDELL, Pearl River, N. Y. The object here is to provide a fastener for securely connecting the ends of the belt with each other so that the belt is exceedingly flexible at the joint, is not liable to fray or ravel at the junction or at the sides of the joint, and the belt is guided to run centrally on the crowns of the belt pulleys over which the belt passes.

CIGAR-CUTTING MATCH RECEPTACLE.—J. P. CROSTHWAIT, Sadieville, Ky. In this device the matches are delivered successively and in a lighted condition, it delivers a match and simultaneously cuts the end of a cigar, it stows the matches in a receptacle to be delivered therefrom successively, and it maintains the lock in the receptacle in operative position until the matches are completely or nearly exhausted.

AUTOMATIC REGULATING DEVICE FOR WATER TANKS.—W. L. BRUBAKER, Harrisburg, Pa. The device is particularly applicable for keeping filled the tanks or troughs disposed in the center of a railway track for the purpose of supplying water to a passing engine. The device is actuated by a float in which the valve mechanism is operated directly by the water pressure from the water main.

Prime Movers and Their Accessories.

GOVERNOR.—J. P. NICKONOW, Evansville, Ind. Particularly stated, this invention relates to improving the valve mechanism forming a part of the turbine and also improving the form of the weights operated by centrifugal force, and also improving the form of parts associated with these weights and with the valve controllable by the governor.

Railways and Their Accessories.

FLUE POINT AND ITS ATTACHMENT TO FLUE-SHEETS.—C. S. COLEMAN, Spokane, Wash. Mr. Coleman has demonstrated by numerous experiments, that, by providing the flue point with a recessed shoulder, and by employing a gasket of soft metal, the same being provided with a bead interposed between the flue-sheet and the shoulder of the flue-point, and by expanding and beading the outer ends of the flue-point he is able to form a tight joint which practically avoids leakage.

Pertaining to Recreation.

GAME APPARATUS.—W. F. SCHNELLE, Cincinnati, Ohio. In this patent the invention relates to games and it has for its object the provision of a board and moving pieces which may be constructed at little expense and which may be used to play an interesting and novel game. The game comprises a base ball field, bases, runners, scoring of points, the playing of innings, and other features of base ball.

SOUNDING TOY.—A. H. F. SCHLIECKER, Vinita, Okla. The toy is adapted to produce snapping sounds of various tones and qualities. The object of the invention is to produce a device which may be cheaply manufactured and which is adapted to produce sounds of various pitches by varying the manner of manipulating the same.

AMUSEMENT DEVICE.—R. FARRELL, Tappan, British Columbia, Canada. Among the principal objects which the present invention has in view are: To provide an apparatus whereby is produced the illusion of floating in mid-air, and to produce a simplified construction for an apparatus designed to produce the above-mentioned desired effect.

Pertaining to Vehicles.

BICYCLE AND MOTOR CYCLE HOLDER.—W. A. SETTLE, Wallace, Idaho. The device is permanently carried on the frame of the cycle, and can be adjusted to hold the cycle in an upright position when not being ridden, the support being adjustable to engage one of the pedals of the cycle so that the latter will be firmly held against movement should the cycle be in a standing position on a grade.

LOCKING DEVICE.—F. D. WINTERLING, New York, N. Y. The invention relates to manually controlled levers such as the controlling levers of automobiles and the like, and its object is to provide a device arranged to securely hold the controlling lever in position against accidental displacement and to prevent the operator from shifting the controlling lever too far.

Designs.

DESIGN FOR A COVERED DISH OR SIMILAR ARTICLE.—C. ZIEGLER, Limoges, France. The design presented is an interesting and ornamental covered oblong dish, with a sloping top and base and end handles. The design includes the representation of neat yet fanciful scroll work, forming a pleasing ornamentation.

DESIGN FOR A GLASS GOBLET OR SIMILAR ARTICLE.—C. O. NORTHWOOD, White Mills, Pa. The ornamental design in this case represents a glass goblet of exquisite body curves, a slightly tapering narrow column connecting it with a flat base. The ornamental features cut in the goblet are very artistic. Mr. Northwood has designed another glass goblet of the same general curves and shape, but with flower ornamentation very dissimilar, and also a third glass goblet with a somewhat decided departure from the other two, and with a broader flower ornamental display in the body.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

The History of French Literature from the Oath of Strasbourg to Chantecler. By Annie Lemp Konta. New York and London: D Appleton & Co., 1910. 8vo., 850 pp. Price, $2 50.

As a general rule, an author divides the prospective readers of his work into two categories, and a book is usually designed with these divisions in view It is intended for the perusal either of the student, or of the general, casual reader, and seldom answers the purposes of both. Mrs. Konta, however, has furnished us with an exception to this generalization, in her excellent history of French literature, and it can truthfully be said that both the student and the lay reader will find much of interest and of high literary value in her book The work is a concise, and clear chronology of practically the whole of French literature, beginning with the formative period The history is technically most thorough and systematic, and that it is the result of long continued, conscientious study and investigation becomes apparent to even the most cursory reader It is naturally difficult to treat a subject of such comprehensive nature, so that its necessary brevity does no violence to the mass of information which must be included but the author appears to have solved this problem successfully The appended bibliography is excellent Another good feature is found in the thorough index, an element so necessary in a book of this kind and so seldom properly done Aside from any pedagogical value, the book is of great interest owing to the many interesting and amusing anecdotes and stories, which the author has compiled from different sources, regarding most of the prominent figures of French literature Many of the anecdotes have been discovered in obscure French sources, and appear for the first time in English in Mrs Konta's book.

The History of Astronomy By George Forbes M A, F R S, M I C E New York and London G P Putnam's Sons, 1909 16mo, 200 pp

Prof Forbes has written a very instructive little book on the history of astronomy which he divides into four periods—the geometrical dynamical, observational and the physical Thus he traces the evolution of intelligent thought in the progress of astronomical discovery and by recognizing the different points of view of the different ages gives credit even to the ancients Although the history has been necessarily curtailed, still it lays before the reader in a limited space just enough about each age to illustrate its tone and spirit to give some conception of the ideals of the works to present logically and gradually different and new points of view and additional means of investigation

Legal Notices

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Cars, drop stake for logging F K Thrall et al 949 985
Carbon and producing it treated P J Mulvey 949 988
Carbureter P J Dasey 950 378
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Carriage curtains etc means for forming socket holes in F S Carr 949 883
Carriage door track E Barth 950 089
Carriage pusher baby H Alban 950 218
Carriage seat extension I A Sturtevant 950 195
Cash register J P Cleal 949 864
Caster W Goldbach 950 154
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Ceiling support D Pemberton 949 909
Celluloid substitute H Heydenhaus 950 392
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Concrete construction reinforced C W Peckham 950 401
Concrete molding machine J C Dunton 949 898
Concrete pile and making the same I E Welsh 950 360
Concrete sewer G Dujardin 950 149
Condenser injector W M Fleming 949 761
Conduit sectional O K Hugo 950 264
Container top, Williamson & Oldham 950 064
Controller regulator W P Casper 949 755
Controller regulator A S Cubitt 949 908
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Core forming apparatus, R. H. Brown 950 202
Core machine, O K Moore 950 184
Corn shocker I L. Dawson 949 078
Cotton packer automatic W B House 949 707
Cotton picking sack and holder R. B Montgomery 950 452
Counter automatic stock P H Davis 950 479
Coupling knuckle pin retainer E. P Kinne 949 772
Cradle L. Vargas 950 312
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Current motor direct A L. Rohn 950,218
Current rectifier, high potential alternating C H Thordarson 950,124

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc This will facilitate answering your questions Be sure and give full name and address on every sheet

Full hints to correspondents were printed at the head of this column in the issue of March 12th or will be sent by mail on request.

(12203) B S writes I here add my experience with treating old dry batteries with hydrochloric acid as it once said in your paper, and this is my view of the matter If a person is in a place where batteries are hard to get, or if he only cares for a set of batteries that will finish the season etc or if he thinks the time that he spends on fixing the old batteries is cheaper than a new set, fixing the old batteries is all right I am in a place where batteries are hard to get and are high I have lots of time to spend on such jobs the acid cost me fifty cents I don t count my time I find the batteries will do about a third or half of the work a new set will do A We think this is reliable

(12204) F McC asks Does a train while running on an absolutely level track and at a very high rate of speed have any less pressure on the rails than when at rest? We have it figured out by a learned professor that a train running around the entire surface of the earth at the rate of 4 91 miles per hour would have no pressure on the rails but we think that he has taken into consideration the circular shape of the earth s surface, and figures that the centrifugal force would throw it away from the center and cause it to have no pressure on the rails at the speed What we want to know is that if it were possible to build a track of equal length, absolutely level regardless of the earth s surface as level as the lines of a ray of light, would a train running at a high speed have any less pressure on the rails than when at rest? If it does have less pressure what law causes it to have less pressure? What force causes it to rise? A There is no reason whatever why a train running at any rate of speed should reduce its pressure upon the rails if the earth s surface is considered as a plane and centrifugal force is neglected while gravity remains constant unless, of course it is equipped with aeroplanes at such an angle of attack as to use wind pressure to decrease its rail pressure It is easy to calculate the speed at which centrifugal force will theoretically balance the attraction of gravity, but it is demonstrably untrue that there is any such effect in practice, for a combination of reasons too long to be discussed here It may be shown that the driving wheels of a locomotive press less on the rail for a part of their revolution at high speeds and even leave it altogether but this is entirely due to inadequate balance of the thrust of the reciprocating parts at such speed, and has no connection with the principle of your problem It is imaginable also that a train might ascend a gradient on a trestle for instance, at such a speed as to leap off at the end and be carried some distance by the ballistic effect of its momentum from which it might be argued that reduction of rail pressure by speed is analogous, but this again is outside the limits laid down in your question

(12205) H L F asks I would like to know if a head of three or four feet of water with an abundant supply of the same can be used in a turbine with anything like a fair efficiency in operation Can you give me an idea of what one could expect to achieve in the efficiency of a turbine so placed? A There is no reason whatever why an unlimited supply of water with only four feet of head should not generate a large amount of power with economy and efficiency provided a suitable turbine especially designed for low head is used and there are many good ones The theoretical horse power developed would be 0 00758 Q in which Q is the quantity of water in cubic feet per minute available of which at least 75 per cent should be obtainable in actual useful work with a suitable turbine

A kindly critic who has been a professor of mathematics for many years has objected to the answer to an inquiry regarding the equation of time which we printed few weeks since that it is not sufficiently exact From the point of view of a mathematician or the astronomer the criticism has some reason. The degree of inexactness of our answer may be seen from the fact that the difference from day to day for the years 1909 and 1910 is not as much as 9 seconds at any time excepting for a few days near the end of December and is less than 5 seconds except for a short time near the autumnal equinox Anyone needing the equation of time exactly must go to the Astronomical Ephemeris for it where it is given for each day of the year at Greenwich apparent noon with the difference for one hour from this time for any other longitude can be calculated For all common uses such as setting a clock for local time by the noon mark or the rising of the sun as we used to do when we were a farmer boy in the country the equation of time as given in an almanac is all that is necessary

Curtycomb, G. G. Whetstone [illegible]
Curtain and shade holder, combined, C. A. Bezel [illegible]
Curtain roller and curtain pole supporter, combined adjustable, J W Thomas [illegible]
Curtain support, adjustable, C. E. Mayer [illegible]
Cut-off for down spouts or conductors, T. B. Hargett 949,871
Cutlery, F. W. Sherman [illegible]
Cutter. See Butter cutter
Cutting table, MacFarland & Eaton 950,468
Cycles, adjustable crank hanger for motor, A. L. Walters 950,127
Decanter, J. H. Friedenwald [illegible]
Dental swaging machine, H. O. Lothamer [illegible]
Die, M. Falk [illegible]
Die, MacFarland & Eaton [illegible]
Display rack, W. L. McCarty [illegible]
Display rack, H. F. Marta [illegible]
Display rack for windows, E. Schmidbe [illegible]
Displaying device, window E. O. Rhodes [illegible]
Ditching machine, F D. Mayer [illegible]
Door hanger, L. Johnson [illegible]
Door lock, sliding, J H. Harrick [illegible]
Draft evener attachment C. L. Helwelt [illegible]
Drawer registering and locking device, cash, W. H. Stepanek 950,147
Drier C. B. Stilwell [illegible]
Drilling machine W L. Smith [illegible]
Drink shaker, J Heinrichs [illegible]
Dry closet, F Smith 949,917
Drying jewelry, etc, means adapted for, A. W Hutchins 949,900
Dye, azo, Rünkel & Herzberg 950,404, [illegible]
Dye of anthracene series, vat, H. Raeder [illegible]
Dye orange red to violet, M. Weiler [illegible]
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Eaves trough hanger, Dreher & Kroake 950,130
Electric fixtures, outlet bracket for, N Hubinger 950,176
Electric furnace A Helfenstein [illegible]
Electric heater, F E. Shailor 950,060
Electric meter, G A Scheeffer 950,079
Electric meter service protective apparatus, M C Cole 950,310
Electric oscillations, apparatus for generating undamped R. Eisenstein 950,207
Electric switch, D M Lee 949 799
Electric switch, H. C Robinson 950,305
Electrodes spacer and insulator for storage battery, L. H. Flanders 950,319
Electrolier D A Stowe [illegible]
Electroplating apparatus, Emery & Gilchrist 950,069
Elevator safety device, M C Schwab 949 947
Elevator safety stop, J Akahe 950,450
Elevators, protective apparatus for alternating current, W N Dickinson, Jr 950,224
Engine, M H. Smith 950,346
Engine controlling device internal combustion, Sweet & Weiss 949,885
Engine igniter gas H. F Briggs 950,136
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Engine muffler R. Troike 950,315
Engine seat and cabinet, locomotive J J. Ekstrand 950,441
Engine sparking device, internal combustion, L. K. Leahy 950,001
Engine starting device, internal combustion, R J Gibbon 950,200
Engines, means for preventing backward rotation of two-cycle, J G Callan 949,894
Envelop cutter, C A Fischer 950,089
Envelop, double flap, G W Cox 950,271
Excavating apparatus air lock for J H Gray 950,888
Excavating raising, and dumping earth, etc machine for W Castles 950 367
Excelsior cutting machine M Stewart 950,011
Exercising apparatus, R G. Gough 950 100
Expansion joint J. D. Walsh 949,811
Explosive engine J F Stahl 950,162
Explosive shell and making same C Stiris 950,083
Expressing machine J J Wheat 949 787
Extension hook, J M. Zuk 950,408
Extension table folding H G W Ott 950,340
Extractor See Vapor extractor.
Eye shade A B Allen 950,303
Fan motor operated, H Manes 950,141
Faucet E. Peterson 950 036
Faucet, measuring, J C Ford 949 890
Feed water regulator A R. Herlache 949,896
Fence wiring machine, O N Baldwin 950,313
Fertilizer distributer attachment for cultivators, Jensen & Austin 949 230
Fertilizer, making R A McVitty 950,455
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Filter cleaning device, L. V Reed 950,118
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Filtering apparatus, milk Seymore & Van Cise 950,211
Fire escape T Schulz 950,246
Fire hydrant Owen & Bates, 950 309
Fireproof building portable C Q Locke 950,140
Fireproof window construction W J Larkin 950 232
Fishing gaff, W R Bettis 949 700
Flange sections, manufacture of deep, G H Everson 950,280
Float combustion indicator, A W K Billings 950,018
Fluids, device for determining the force or velocity of G H Whitcher 949,763
Flushing apparatus, J A Staples 949,868
Flushing tank, J P Glennon 949 937
Folding knife W A Hall 950 102
Furnace See Electric furnace
Furnace F H Swift 949 788
Furniture construction M R Stockwell 950,194
Fuse percussion, R A Gathmann 950,[illegible]
Fuse replacing device W L. Green 950,[illegible]
Fuses caps, making fiber F Dutcher 950,381
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Garbage can W B. Osborn 950,456
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Gas engine W R. Kellogg Jr 950,[illegible]
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Gear variable speed, J Sturgess 949 772
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Gearing J Newwold [illegible]
Gearing device W F Phillips 950,408
Gearing transmission, S. S. Scott 950,144
Gearing, variable speed transmission, A. J Honecker 950,010
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Glass shield water Montgomery & Dodge [illegible]
Governor for explosive engines, reversing, J P. Swift [illegible]
Grader, J W Beasley 950,273
Granular material holder and measuring device for, A A. Hauty 950,290
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Hammock stand, W. C. Paske [illegible]
Hand drill, F F Beck [illegible]
Harrow draw bar, F. F Adin [illegible]
Harvester, corn, B. M Houck [illegible]
Hasp, B. F Brock [illegible]
Hat brim matricing and flanging machine, C R. Barkett 950,244
Hat holding and rotating device F D Saylor [illegible]
Hay presses, self tier for, B F Sweeney [illegible]
Heat energy, utilizing, W H. Smyth [illegible]
Heater See Electric heater
Heating mediums by an expansible fluid in a thermostat, device for automatically regulating, E. Regenvary [illegible]
Heddle, Fehr & Kaufmann [illegible]
Heel finishing machine, G. Pease [illegible]
Heel for boots and shoes, pneumatic, J. S. Beaty [illegible]
Hinge, J. T Trotter [illegible]
Hinge, C. T J Giles [illegible]
Hinge, concealed, E. Williamson [illegible]
Hoist, below surface, A. [illegible]
Hoisting and delivering mechanism, [illegible] Morris [illegible]
Hook [illegible]

TWO REMARKABLE SHOWS.

(Continued from page 198.)

The W. H. Mullins Company exhibited, as heretofore, several of its small steel boats, but the construction novelty of the show was a hull built of phosphor-bronze plates riveted together and attached to the ribs by means of U-shaped clamps passing over the latter and riveted to the hull. These boats were constructed by the Davit & De Groot Company, a firm which has had a great deal of experience building riveted steel-hull lifeboats for the United States government. The phosphor-bronze hull has a great advantage over the steel hull on account of its non-corrosive qualities, and in addition to this the new construction does away with rivets through the ribs. In a 36-foot cruiser exhibited by the same concern, there was installed a new type of hydraulic steering gear, which consists of two carved cylinders with movable plungers placed at the steering wheel and connected by means of small copper tubing to similar cylinders placed at the rudder. The cylinders and tubing are filled with a mixture of oil and glycerine, a very slight movement of the transmitting pistons at the steering wheel being sufficient to actuate the rudder positively. The mixture used is non freezing, so that cold weather does not affect it. This steering gear appears to be a decided improvement over the usual form, since it is easily worked and is more or less self locking.

Probably the most popular craft exhibited were the open speed boats, which vary in price from $1,000 to $3,000 or $4,000. Twenty five miles per hour was the highest speed guaranteed by any of the makers of these boats exhibited, and the majority of them do not make more than 18 or 20 miles an hour. For the man of small means who is content to travel slowly, there were boats (open launches) varying in price from $104 to $1,000. Some of these launches were fitted with automobile tops. The cruisers were larger and more comfortably fitted out than ever before. The price of those boats is low compared with their size and usefulness. An average speed of 10 or 12 miles an hour is all that is aimed at with this type of boat. In many instances electric lights run from an ignition dynamo were fitted, while comfortable bunks, a small galley, etc., were the rule.

The exhibit of engines this year was a large one. While many manufacturers still stick to the 2-cycle motor, this is used chiefly on low powered, slow-speed boats having one or two-cylinder motors. The speed craft almost invariably are fitted with 4 or 6-cylinder motors of the 4 cycle type. A 100 horse-power Mietz & Weiss reversible kerosene-oil engine was one of the striking engines exhibited, also a 225-horse-power 8-cylinder 4-cycle motor built for a racer by the Jencick Motor Company. The Dean Manufacturing Company showed the 8-cylinder 80-horse-power 2-cycle engine with which they made their record run from St. Louis to New Orleans last year in the "Brer Fox II." The Standard Motor Construction Company exhibited a complete line of motors, including the 125-horse-power double-acting 6-cylinder engine used by the Russian government on its submarine. The smallest and lightest marine motor exhibited was the Waterman 1½-horse-power 4-cylinder motor shown in a small 14-foot boat intended for a young lady. This motor weighed about 100 pounds complete. One of the novelties of the show was an inclosed fly wheel having pockets around its periphery. The discharge of the exhaust into these pockets helped to turn the motor, the flywheel thus acting as a muffler. A new form of timer, consisting of a small cogwheel revolving within an internal gear, was exhibited. A specially built steel boat fitted with 150 compartments, and intended to be used in navigating the rapids of Niagara was shown by the Detroit Boat Company. With this

(Continued on page 210.)

Horses, mules, etc. overshoe for, T. J. Griffith	950 121
Horseshoe, H. T. Baron	950,420
Hose gate, A. T. Miner	950,111
Hotel lock, A. Arens	950 318
Hub, wheel, G. W. Grooms	949,959
Incinerating receptacle and chute, N. W. Lowe	949 (illegible)
Incubator heater, J. W. Sauer	950 245
Insole machine, M. Watry	950,199
Internal combustion engine, I. Du...	949 758
Internal combustion engine, O. McDowell	950,297
Iron into steel, composition for converting, G. F. Dies	950 095
Ironing board, G. Wynder	950,087
Ironing board and washstand, combined, J. H. Havecotte	950 104
Ironing machine, S. J. Miller	950,399
Ironing table, A. H. Hauser	949,894
Irrigation ditches head gate for, G. L. Kinser	950 138
Jack and drop, combined, C. D. Shochs	949,880
Jeweler's gage, H. V. Bernhardt	950 221
Journal bearing, R. D. Priest	950 064
Journal box, H. A. Perkins	949 910
Journal box, F. Helmick	950 391
Kerosene burner for melting furnaces and similar uses, J. T. Kuehl	950,231
Kneading and mixing machine, C. G. Ross	950 248
Knob construction, A. Arens	949 967
Labeling machines, label supply mechanism for bottle, E. Ermold	950 259
Labeling machines, wiper mechanism for bottle, F. Ermold	950 260
Labeling machines, wiper attachment for bottle, E. Ermold	950 261
Lacing belt, A. J. Sloneker	950 000
Ladder, ceiling, A. B. Mercer	950 183
Ladder step, H. H. Gaffers	950 323
Lamp, arc, E. Hewson	950 000
Lamp, automobile, C. J. Schmalzried	949 846
Lamp socket, electric, F. A. Lavercombe	949 965
Land roller, A. H. Smithson	950 412
Lasting machine, J. Armbruster	950 219
Latch, Reeve & Hall	949 849
Latch, D. W. Tower, 949 801	949 862
Latch, gate, J. N. Welker	950 063
Latch, gate, Sprague & Mulroyan	950 307
Leather founding device, D. Driscoll	950 006
Leather treating machine, W. P. Book	950 430
Lens grinder, G. H. Flad	949 760
Level device for braces, etc., H. H. Pugh	949 842
Level, plumb, A. E. Young	950 100
Lever, uncoupling, J. J. Hannon	949 824
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boat, two men expect to make the hazardous 7-mile trip through the rapids and the whirlpool next summer to Lewiston, Canada.

The motor boat industry, as mirrored by the 1910 show, is increasing by leaps and bounds. Already there are 50,000 motor boats in use in this country, and it is safe to say that by the end of another year this figure will be materially increased.

THE FIRST AMERICAN AERONAUTIC SHOW AT BOSTON

The two general views of the Boston aeronautic show reproduced herewith will give our readers a good idea of how well-filled was the large hall at Mechanics Building with the machines of American inventors at the recent show. While a few of the aeroplanes exhibited were on the lines of some of the successful European models, most of them were patterned after American models, such as the Curtiss and Wright biplanes and the Pfitzner monoplane. In one of our illustrations a monoplane on the general lines of the Bleriot (the "Morok") with the sliding wing tips invented by Pfitzner instead of wing warping, appears in the foreground, while the large Antoinette type with triangular body and the smaller Bleriot type monoplane were both exhibited by the Scientific Aeroplane and Airship Company of New York. Both of these machines were constructed by Stanley Y. Beach.

Another general view of the hall shows the former of these two monoplanes in the foreground. Another monoplane of original construction (the "Burlingame") appears in the distance, while hanging from the ceiling is a biplane glider constructed and used by the students at Boston "Tech," and just below this another glider built by two boys after a description published in the SCIENTIFIC AMERICAN. The balloon "Boston," the club balloon of the Aero Club of N. E., is seen partially inflated in the center of the hall, while on the right-hand side are seen several balloon baskets, among them being that of Leo Stevens's small one-man balloon "Mercury" and the basket of a 160,000-cubic foot balloon capable of carrying 20 passengers.

The L. A. W. biplane and revolving cylinder 2-cycle motor was one of the novelties of the show. This biplane was constructed somewhat on monoplane lines, there being a rectangular body extending out behind and carrying the biplane horizontal rudder for steering up and down. The motor was mounted on trunnions close in front of the main planes, which mounting makes it possible to direct the propeller upward slightly when the machine is running along the ground in order to rise. The new revolving-cylinder motor used on this machine is said to be one of the lightest motors of this type yet produced. It is soon to be put on the market in two sizes of 50 and 100 horsepower.

Besides the aeroplanes shown in our photographs, there were numerous other full-size machines. Most of these were described in our last issue. A Farman machine like that used by Farman at Brighton Beach in 1908 was put on exhibition when the show was half over. This machine was the only aeroplane said to have made a short flight previous to the opening of the show.

THE UNBALANCED BULLET.

(Continued from page 203.)

based, indicated plainly that the cause, so simple after discovery, was not even surmised. Their attempts to reduce it were based upon the theory that the blast of powder gases at the muzzle, or some condition of the rifle bore at the muzzle, was responsible for this apparent sudden change in direction of the bullet's flight at this place.

Persistent screen shooting and continued elimination of errors that were

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(Concluded from page 210)

known, indicated clearly that this X error was not the only error Another cause was at work which added to or subtracted from the X error, and while experimenting for this the author designated it the "Y error."

He had known for years that tipping bullets make a spiral flight as they pass through the air E A. Leopold determined the diameter of some of these spirals several years ago It was generally believed that a bullet often makes a spiral flight over the range, and the cause of this Y error at the target seemed to have some connection with this spiral in the air, which nearly all unbalanced bullets describe The author's own screen shooting exhibited clearly the diameter of many of these spirals and the distance from the muzzle at which the spirals commenced He found the cause of the Y error to be as simple as the cause of the X error

The X error spiral ends at the muzzle, while the Y error, in the air, commences about 12 feet from the muzzle The bullet makes an apparent change in its direction when it leaves its X spiral at the muzzle, and it makes another change in its direction when it goes into its Y spiral The resistance of the air upon a tipping bullet produces its air spiral, and the rigid walls of the rifle barrel produce the X spiral described by an unbalanced bullet in the bore The pitch of the X spiral, or the distance of one turn of the spiral to the next, is the same as the rifle twist which for a 0 32 caliber is about 12 inches The pitch of the Y or air spiral is about 45 feet

The diameter of the bore spiral varies from a fraction of a thousandth of an inch to several thousandths of an inch. The diameter of the air spiral varies from a few thousandths of an inch to 7/16 of an inch, depending upon the amount the bullet tips in its flight The air spiral, of course, results from the fact that the tipping bullet does not point in the direction of its flight

The causes of these two errors, X and Y, are the same in principle, but their positions are reversed The workings and explanations by actual experiments, well illustrated, are set forth very elaborately by the author

The following conclusions may be drawn from the book

In careful rest target work, under favorable shooting conditions, the $X + Y$ error at the 100 or 200-yard target is about 80 per cent of all errors The X and Y results from the fact that the tangent of a spiral (c c) forms an angle with the axis of its spiral (d d), as may be seen in Fig 3 The bullet as a whole makes a spiral flight while in the rifle, because it is unbalanced or because it does not lie central and straight with the bore It makes a spiral in the air because it is a tipping bullet It is a tipping bullet because it was unbalanced when it left the muzzle The unbalanced bullet, with respect to the center of the rifle bore, is therefore the prime cause of its X and Y errors

To overcome the error which is inherent in the rifle and its ammunition, the bullet, before being shot, must be a balanced one, that is, its center of gravity must coincide with its center of form The powder charge must produce uniform pressure from shot to shot. The rifle barrel and ammunition must be so constructed that the projectile remains balanced throughout the entire bore

To have a projectile start from the muzzle in the right direction, that is, in the line which forms the center of the bore, the entire bullet just as it leaves the muzzle must be symmetrically balanced around the line of fire Any reasonable rifleman would admit this last statement. What the author's work has disclosed, however, is to point out clearly the fact and its importance, and to show mathematically that practically the whole error at target attributable to the modern rifle and its ammunition originates in the unbalanced projectile.

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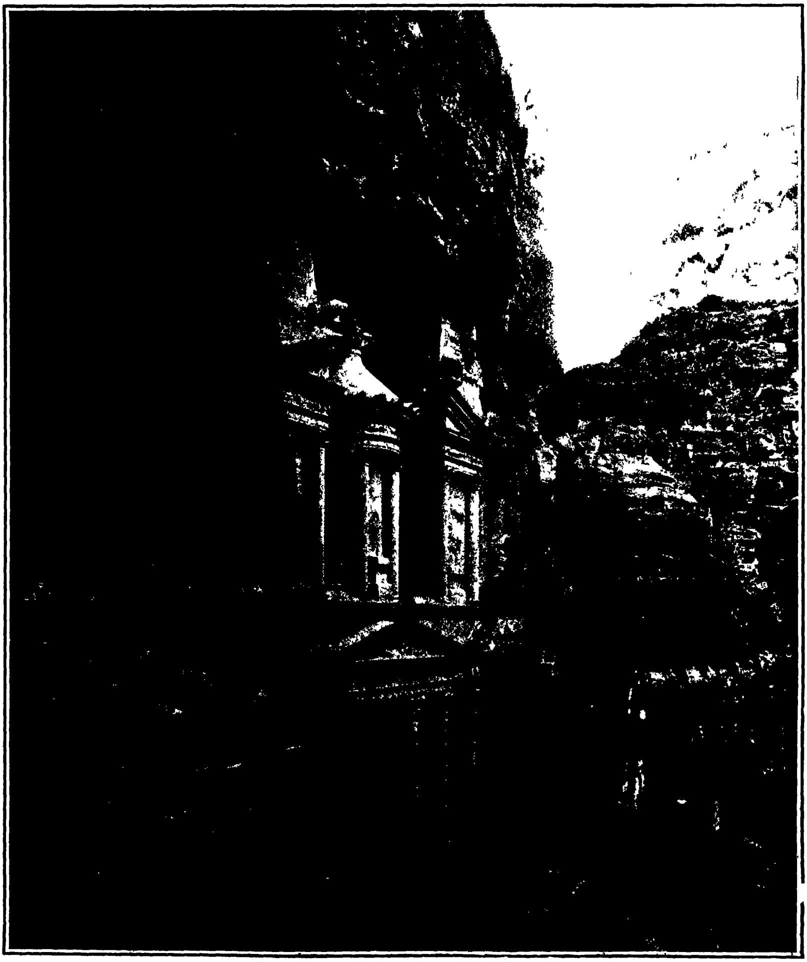

El Khazneh el Farioun (the treasury of Pharaoh) Petra.

This is in some respects the most remarkable of the beautiful temples and tombs of Petra, the rock hewn capital of Edom and later of the Nabataeans whose king Aretas, mentioned in 2 Cor. 11: 32, extended his conquests as far as Damascus. This monument of antiquity is thought to be the work of the Romans, being attributed by some to the Emperor Hadrian who visited the place in A. D. 131. The color of the sandstone rock from which this vast monolith was cut is a delicate rose pink. The imposing façade shows two rows each of six majestic columns. It terminates in a miniature temple crowned by a huge urn said to contain treasures of Pharaoh. The angle at which the photograph was taken well shows how the temple was cut from the rock.

A CITY HEWN OUT OF SOLID ROCK.—[See page 220.]

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NEW YORK, SATURDAY, MARCH 12th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE "WHIP-CREATION" BATTLESHIP

THE Washington correspondent who is responsible for the distribution of naval and military news to the daily press of the country has been writing some extremely silly nonsense about the two battleships which the House Naval Committee has recommended for this year's programme, and he has put into the mouth of Secretary Meyer statements as to the objects which have inspired the request for these two powerful vessels which we are perfectly satisfied the Secretary could never have uttered. According to the dispatches the motive responsible for their unprecedented size, reported to be from 30,000 to 32,000 tons, is the desire to build a couple of ships which shall be bigger than anything else afloat and give to this nation the prestige of possessing battleships which in respect of size and terror producing qualities shall be supremely of the "whip-creation" order.

It is sufficient to say once and for all that the day of whip-creation sentiment has long ago passed—if indeed it ever existed except on the street or in the music hall ballad. Certainly it was never a motive in the upbuilding of the United States navy. Our frigates of the sailing days were built swifter and armed stronger than the ships then afloat in other navies not for the vainglory of being able to say that they were swifter and more heavily armed but for the very practical purpose of overtaking the enemy, bringing him to action and crushing him by superior gun fire. The policy of that early time has been the policy of our navy in the intervening one hundred years and it is its policy to-day. If Secretary Meyer believes it to be expedient to build a ship many thousand tons larger than anything contemplated abroad, we may rest assured that it is because he and his naval advisers believe that to maintain our traditional superiority in gun fire we must move up from the 12-inch to the 14-inch gun and increase our displacements in proportion.

The most efficient battleship is the one which embodies the maximum amount of all-round military efficiency on the minimum amount of displacement. Unless the present theories of naval designers are very much at fault, a ton of displacement in a big battleship gives more military value than it does in a ship of smaller size. Thus 20,000 tons in a "Delaware" is a more valuable asset than the same displacement in two "Oregons." Here then is another cause of the rapid growth in recent years in the tonnage of the first-class fighting ship. From the 12,500-ton "Maine" our ships of the first line have grown through the 16,000 tons of the "Connecticut," the 20,000 tons of the "North Dakota" and the 22,000 tons of the "Florida" to the 26,000 tons of the two great vessels "Arkansas" and "Wyoming" which are now upon the stocks.

The big jump of 25 per cent in displacement between the "Connecticut" and "North Dakota" was due to the coming of the dreadnought type and the adoption of an exclusive main armament of 12-inch guns. To-day we are on the eve of another great advance, and again it is due to a great increase in the weight and power of the battery, this time by the substitution of the 14-inch for the 12-inch gun. The House Committee on Naval Affairs has accepted, we are glad to see, the Secretary's programme for increasing the force of the navy by two battleships, two fleet colliers, one repair ship and four submarines of a new type of unusual speed and steaming radius. According to the provisions, the battleships are to be of at least 26,000 tons and each ship is to carry ten 14-inch guns, the ships being made of sufficient displacement to carry this battery. The 14-inch gun, however, with its mount, ammunition, etc., is so much heavier than the 12-inch that the new vessels, even though they carry two less guns, will have to be of at least 28,000 tons displacement, and if it should be decided to mount twelve such guns, the displacement may run up to 30,000 tons and over. Because of the greater punishing power of the 14-inch gun at *long ranges*, a battery of ten 14-inch would greatly outmatch one of twelve 12-inch. There is no ship afloat or contemplated *so far as we know*, among the navies of the world, that could withstand such a vessel.

HIGH-SPEED TELEGRAPHY.

SOME very remarkable testimony has been elicited by the Joint Committee of the Legislature which is investigating the question of extending the jurisdiction of the Public Service Commission to and over telephone and telegraph companies. It is remarkable as seeming to indicate that in spite of the large amount of thought, ingenuity, and mechanical skill which have been directed with marked success during the past few decades to the improvement of the speed and lowering of the cost of telegraphy, practically the whole of the business of the big telegraph companies is to-day sent by the hand-operated Morse key, in much the same way and at no greater speed, than when Morse first made telegraphy a practical commercial art. Thus, according to the testimony of Col. Clowry, president of the Western Union, the maximum speed of transmission is obtained in their service by two systems, the Wheatstone and the Barclay, the former having a capacity of 125 words per minute, and the latter of 90, with an average of about 50 in practical use, and these two forms of apparatus, it would seem, represent the only departure made by the Western Union Company from their almost universal practice of operating by hand by the Morse key.

Side by side with this evidence testimony was given that rapid telegraphy systems have been developed here and in Europe with capacities of from 500 to 1,000 words a minute and over, one system, established in several centers in the United States, being now in daily use, which is sending messages at a rate of 1,000 words per minute. The public will naturally ask, if such high speed be possible, why do not the telegraph companies make use of the system and so increase their capacity and make the corresponding decrease in rates. In his testimony Col. Clowry explained that the Western Union's is a one-message business, and that the company cannot hold messages until they get a sufficient number to send at a 1,000-word-a-minute rate. This is true as regards the single short message, but in the case of the longer messages approaching the manuscript letter length, the type of business which would be certain of enormous development if it were offered to the public throughout the whole twenty-four hours of the day at the low rates which would then be possible—it would be practicable to set half a dozen operators at work simultaneously in punching the sending tapes and the message could be sent through in less than one-tenth the time that it would take by the present methods. The transmission of Peary's 8,000-word message from Indian Harbor to the New York Times was quoted as a great feat in telegraphy. It took a force of twenty operators three days to get the message through. By the rapid telegraphy system the same message after being prepared on the tape could have been sent over a single line in about ten minutes' time.

The high-speed methods as worked out by Hughes, Murray, Pollak-Virag, and Delany claim to send at the rates respectively of 4,500, 16,000, 36,000 and 60,000 words per hour. The significance of these methods to the public is that by their use the telegraph could be extended, cheapened and popularized until it was as available to the ordinary citizen as the far more highly developed telephone of the present day.

NEW YORK AND PARIS SUBWAY SYSTEMS COMPARED.

NEW YORK CITY is justly proud of its subway system, but it will be a surprise to some of us to learn that the subway system of Paris actually carries a larger number of passengers during the year, the total being 282,000,000 as against 200,000,000 carried on the New York system. Outside of the mere fact that more people were carried the comparison is entirely favorable to the New York subway. The details of the following comparison have been worked out by R. H. Whitten, the Statistician of the New York Public Service Commission, and they afford upon a most timely subject a mass of valuable information, which is a credit to the compiler and cannot fail to be of great service to the Commission in its important work of regulating transportation matters in this city.

There are certain points of similarity between the two subways. Both have been built and are owned by the city, and both are leased for a term of years to an operating company. The length of the two systems in miles of single track operated was in 1908, the year for which the latest figures are available, very nearly equal. But the Paris system, which is entirely two-track, forms a network of lines covering a district having a radius of three or four miles from the business or traffic center, whereas the New York system has a single *stem* terminating in two long forks at the upper end, and extending 14 miles to its most distant point from the Brooklyn Bridge, which may be called the chief traffic center. The Paris subway has no express service, whereas the New York subway has four tracks carrying express and local service for six and a half miles through the most congested district.

The population of the district served by the subway system was 2,750,000 in New York and 2,790,000 in Paris. The area of the city proper of Paris immediately tributary to the subway is 31 square miles, the area of Manhattan and the Bronx served by the subway is 62 square miles. Hence the population of the *district served by the Paris subway is more than twice as dense* as that served by the New York system. There is a total of 64.6 miles of single track in the New York and of 62.2 miles in the Paris subway.

The great superiority of the New York system is due to the frequency of the trains and the higher speed of travel. In Paris during 1908 the least headway during rush hours was 2 minutes and 33 seconds and the greatest 7½ minutes. The least headway in the rush hours of the express trains in New York was 2 minutes and the greatest 4 minutes. The maximum length of the Paris train was 236 feet, of the New York train, 411 feet. The average speed in the Paris subway is 12 miles per hour, and in the New York subway, 18 miles per hour, the average speed of express trains between Brooklyn Bridge and 96th Street being about 24 miles per hour and the average speed of the local trains about 15 miles per hour. The maximum speed in the New York subway is 40 miles per hour, as against 21.7 miles per hour in Paris.

The rates of fare in Paris are first class 4.8 cents, second class 2.9 cents, and second class round-trip tickets 3.8 cents, equivalent to 1.9 cents per trip. In New York there is a uniform fare of 5 cents, but while the fare in New York is 5 cents, the average length of ride per passenger is from two to two and a half times that in Paris.

In Paris the capacity *of each car* is determined by the government, and in 1908 the average number of passengers per car was 64. The capacity of the New York cars, both seated and standing, estimated on the Paris basis, was 103, but this frequently rises to 150, and even 170 passengers per car. In Paris the number of standing places is fixed by the government, in New York the limit is apparently fixed by the ability of a burly platform guard to boost the passengers in by a well-directed football rush. But were the government allotment of floor space, as obtaining in Paris, applied in New York, the maximum capacity of a New York subway car would be cut down from 170 to 103. The number of passenger-place-miles per mile of track was 73,000,000 for New York and 36,000,000 for the Paris system, and yet, as we have seen above, the Paris subway, because of the shorter length of the trips, carried a greater number of passengers in the year.

Congestion in Paris is not nearly so great as in New York, first, because traffic is more evenly distributed throughout the day, secondly, because the currents of traffic in Paris move in both directions during the rush hours, and thirdly, because the passenger in Paris takes a shorter average ride, and vacates his place for others. The longest possible ride on the New York subway is 17½ miles, though it is not probable that many people take the trip from Atlantic Avenue, Brooklyn, to 222nd Street, New York, for the pleasure of the trip, and certainly not many for business purposes. The total cost of the New York subway and its equipment was $87,938,000, consisting of $51,290,000 actually paid by the city for the construction of the subway and $36,648,000 that the company claims to have expended for both equipment and construction, including $10,048,000 which it claims to have spent in the construction of the subway from Brooklyn Bridge below Broadway and the East River to Brooklyn. The total cost of the construction and equipment of the Paris subway is estimated at $62,258,000.

The New York subway fared much better than the Paris subway in the matter of taxes, the former paying but $900 per mile of single track as against $4,200 per mile paid by the Paris subway. The New York subway considered as an economic undertaking earned about 7 per cent on the capital invested, while the operating company earned about [illegible] per cent on its reported investment. The Paris subway earned 7½ per cent on the total estimated cost of construction and equipment, and the operating company earned 5 per cent on its reported investment.

ENGINEERING.

A recent wreck on the London & Brighton Railway, England, when an express left the rails and crashed into the railway station, has again illustrated the light construction of English cars. A Pullman car was comparatively little damaged, whereas the ordinary day coaches were completely wrecked.

The new single-phase electric freight locomotive which has been built for the New Haven Railroad was recently given a test between New Rochelle and Stamford, a distance of 17 miles. The load consisted of thirty loaded freight cars, and the distance of 18 miles was covered in 27 minutes without pushing the engine to its full capacity.

In a paper before the Engineers' Society of Western Pennsylvania, E. F. Bulmahn described a new type of bituminous gas producer which embodies the good features both of the up-draft and the down-draft type overcoming the production of tar and completely consuming the fixed carbon. There are two fuel beds, one operated as a down-draft producer to break up the volatile matter, the other as an up-draft producer to consume the fixed carbon, the resultant gas being taken off at the center of the producer.

Time was when it took nearly six years to build a battleship in private yards in the United States, but the construction of the "Connecticut" at the government yard at Brooklyn set a pace which has steadily accelerated. The "Mississippi," whose trials took place as recently as October, 1907, took 44 months to construct. The "New Hampshire" December, 1907, was built in 38 months, the "North Carolina" (cruiser), January, 1908, in 36 months, "Michigan" (battleship), 1909, in 24½ months, the "Delaware" (battleship), October, 1909, in 27 months.

Vast improvements are being made in the Trans-Siberian Railway which, in addition to being double-tracked, is being largely relocated with a view to the elimination of grades and the shortening of distance. When the work has been completed the distance from Paris to Peking will be 6,300 miles instead of 7,500 miles over the present line *via* Harbin and Mukden, and the fourteen days now consumed on the trip will be reduced to nine and a half days. The value of these improvements will be as great from the military point of view as they will from that of passenger and freight traffic.

Speaking on the relative economy of the single-phase and direct-current systems for steam railroads Mr. George Gibbs is of the opinion that maintenance costs of the single-phase system as at present developed will be somewhat higher than for the direct current though eventually they should be about the same. On the other hand, he estimates that about 13 per cent less energy would be required at the power house for the single-phase than for the direct-current system. Adding the saving in sub-station operation, he looks for a saving of from 4 to 5 per cent in the total operating cost in favor of the single-phase system.

The tremendous floods of the past season on the Isthmus of Panama have helped to demonstrate, even before completion, the wisdom of building a high level rather than a sea-level canal. Through the swamp near Gatun the bottom of a sea-level canal would be some 50 feet below the general ground level, and at Gamboa, where the Chagres River pours its enormous and sudden floods across the canal cut, the river bed would be 90 feet above the canal bottom. Under the torrential downpour, the discharge of alluvial silt into the canal would make necessary constant dredging, and might result in the temporary obstruction of the channel.

There is great activity just now in experimental work in the direction of speed-reducing gears for marine turbines. We noted in our issue of February 12th that the Melville-MacAlpine mechanical gear has shown a shop efficiency of 98.5 per cent. The Parsons Marine Steam Turbine Company have installed a helical reduction gear on the 1,000-ton steamship "Vespasian," with which they claim to have obtained a shop efficiency of 98 per cent. The Dr. Foettinger hydraulic reduction gear has shown an efficiency of 80 per cent. This last-named gear, however, is said to have the great advantage of being quickly reversible.

Prof. O. Paul Monckton of Calcutta sends us a preliminary description of an enormous steel tank, 330 feet square by 6 feet deep, carried on steel columns at a height of 90 feet from the ground, which has been built to act as a reservoir for the water mains of the corporation. Because of the limited bearing capacity of the local silt underlying Calcutta, the tank has been built upon a monolithic bed of concrete weighing 30,000 tons. The tank itself weighs 10,000 tons, and the water about 40,000 tons. The supporting columns are in groups of four, braced together; but as a precaution against the action of earthquakes the groups are not interbraced, the object being to [illegible] vibration and to provide a certain flexibility. The cost of the work was $600,000.

AERONAUTICS.

The latest German airship—"Parseval V"—left Bitterfeld at 10.15 A. M. March 1st on a voyage to Berlin. The capital city was reached safely, the 80 miles being covered in 4 hours. This airship is the smallest non-rigid passenger-carrying dirigible yet constructed. Its length is but 30 meters (90 feet).

With the same make of 50 horse-power revolving-cylinder motor used by the ill-fated Delagrange, and which drove his machine at the rate of 50 miles an hour, Le Blon flew 10 kilometers (6.21 miles) in 8 7 4/5 (45.82 miles per hour) and Balsan 5 kilometers (3.1 miles) in 4 1 (46.38 miles per hour) at the first foreign aviation meet of the year at Heliopolis, near Cairo, Egypt. Both were awarded prizes.

The 1910 model Bleriot monoplane has a body only 6.6 meters (21.64 feet) in length. The body is completely covered. There are wide horizontal fins on each side at the rear, forming a tail, and the horizontal rudder is in two parts, one of which is hinged to the rear edge of each fin. The tail resembles that of the Antoinette monoplane, but Bleriot still uses a rectangular-section body instead of the V-shaped form which imparts to the Antoinette machine its excellent transverse stability.

The recent decision of Judge Hand against Paulhan in the Wright brothers' suit, the granting of a preliminary injunction, and the requirement of a $25,000 bond for one month in case Paulhan wished to continue his flights, has put a sudden end to the making of exhibition flights in America by this daring record breaking Frenchman. The bond was reduced to $12,000, but Paulhan's manager although under contract to pay him $6,000 per week has brought the aviator to New York to await the result of an appeal. The case will be reopened on the 12th instant.

Gen. Brun, the French Minister of War a month ago inspected at Villacoublay the four Wright biplanes which have been built for the French army. Count Lambert explained the mechanism but made no trial flight because of an extremely high wind. At the same time the army Antoinette and Farman machines were inspected at Mourmelon by an artillery officer, Commandant Estienne. On the 3rd ultimo Van den Born made a 35-minute flight in one of the Farman biplanes, carrying a useful load of 201 kilogrammes (443 pounds). On March 1st Lieut. Cammaran of the Engineer Corps flew 38 miles in a similar machine. Bleriot also has been instructing Lieut. Aquaviva with success.

A man who has made a thorough investigation of the accident to the Bleriot monoplane which cost the life of Leon Delagrange, has concluded that the accident was the result of the aviator getting "rattled" for an instant when he was flying low and was about to turn. It is this man's belief that Delagrange threw his control lever too far to one side—thus warping the wings too much and tipping the machine severely—and then too far to the other, the result being that the machine swayed so violently that it turned over. It struck the ground upside down, and all the guys etc. on the under side were found intact. A spacing strut between the wings (which the constructor claimed had been left out) was found in place and unbroken. As far as could be ascertained, everything was in good order and the accident was not due to the failure or breakage of any part of the mechanism.

Now that Germany has produced several "men birds" many new aeroplane inventors are rapidly appearing. The majority of these favor the monoplane, with which type the first $10,000 cash prize (the Lanz prize) was won by Herr Grade last fall. Dorner and Hilsman are two of the latest successful experimenters with this type of aeronef—to whom should be added Major von Parseval, who has a huge 14-meter (46-foot) span monoplane fitted with a 114-horse-power motor. This machine is undergoing its preliminary tests on the shore of the lake at Plau in Mecklenburg. On March 1st Herr Paul Lange attempted the first aeroplane flight to be made at Dresden. He rose to a height of 40 feet, when a violent wind gust capsized the machine, which fell and was badly demolished. The aviator escaped with bad bruises.

The making and flying of model aeroplanes is a scientific diversion from which much may be learned. Several interesting new forms of aeroplanes have been developed from models, and many amateurs have learned the behavior in flight of the various types of machines. Hence the first national contest of the Aeronautic Society for the Chanute cup and other prizes, which was held in the 69th Regiment Armory, New York city, on the evening of March 3rd, was largely attended. Several small monoplanes having planes made of wood were flown by L. J. Lesh. Mr. Dalkranian had a Langley-type machine with 4 large propellers, one at either corner. All the models were launched from a table. The longest flight—148 feet—was made by the monoplane of Frederick Watkin, a 15-year-old boy. Other contests will be held weekly in the armory.

SCIENCE.

Prof. Herschel C. Parker of Columbia University announces his intention of attempting to ascend the Alaskan peak, Mount McKinley. He states that either he will reach the summit or prove that it can be reached only by an aeroplane.

The alcohol produced from sawdust and wood must not be confused with wood alcohol, for, although standard alcohol is primarily made from wood, it is produced directly by the fermentation of a pure sugar solution, into which the wood is first converted, and it is the same, both chemically and physically, as the alcohol made from grain.

Knud Rasmussen, the explorer, will sail in June for Greenland on an expedition which will consume four years. The ethnographic study of the Eskimos is the purpose of this expedition. One year will be spent at Cape York and a year each at Hudson's and the Crown Bays. After the navigation of Baffin's Bay Rasmussen expects to circumnavigate Alaska and to sail to the Aleutian Islands and return via San Francisco.

Sir Ernest H. Shackleton, the Antarctic explorer, who is to lecture in this country, will arrive on the Lusitania on March 25th. Before the explorer leaves Washington, where he will be the guest of Ambassador Bryce, he will receive from President Taft the gold medal of the National Geographical Society. While in New York he will be presented with the gold medal of the American Geographical Society of New York.

Prof. E. E. Barnard of Yerkes Observatory informs us that on February 27th last he obtained with a one-hour exposure a photograph of Halley's comet, showing a faint tail of two degrees, equivalent to a length of about fourteen million miles. This is rather important in relation to the question as to whether the tail will reach the earth on May 18th. From these photographs taken so far from perihelion, it seems that the tail will be amply long enough to reach the earth.

The Royal Geographical Society of Italy, at a largely attended meeting, ratified the recommendations of the committee relatively to the bestowal of medals and other distinctions for the year 1909. These include a gold medal to Robert E. Peary for the discovery of the North Pole, silver medal to Captain Robert A. Bartlett, who commanded the steamship "Roosevelt" on the Peary expedition, gold medal to Lieutenant Sir Ernest H. Shackleton, for his "nearest South Pole," silver tablet to the Duke of the Abruzzi for his expedition to the Himalayas where he made a record ascent.

The moving picture is now applied to educational purposes. Chemical tests are now exhibited on the screen. There are films illustrating the electrolysis of water, action of nitric acid on silver and action of aqua regia on metallic gold etc. The test tube is thrown on the screen many times enlarged, and the chemical action is clearly illustrated. Most unsavory but educational is a film illustrating the peril of the fly. The flies are shown laying eggs in unsavory places and before the eyes of the spectators the eggs develop in heaps of wriggling maggots. In the final stage the winged fly is shown in all its unsanitary glory. Still another film exhibits the acrobatic fly lying on its back juggling various articles with its feet and even swinging a dumb-bell as large as the insect itself.

In the possession of Knox Hall of Natural History with its invaluable specimens Hamilton College is especially fortunate. By the kindness of the Hon. James Knox, LL.D. '30, the original building was reconstructed into a hall suited to the display of all sorts of natural history specimens. The most important collection on exhibit is that of the New York State minerals, together with related minerals from Canada. Among these specimens are found many rare ones the best of their kind in existence. In addition to these minerals are 2,400 specimens of fossils and rocks to illustrate the geology of New York, 1,750 specimens to illustrate the geology of the United States, 600 fossils, mainly from the Silurian formation of Europe. Several thousand valuable specimens in paleontology 10,000 specimens of ores and minerals 2,000 specimens of land, fresh water, and marine shells 300 specimens in ornithology from China, 13,000 specimens in entomology, supplemented by a fine group of specimens in ornithology and comparative anatomy. A rare collection of Japanese shells and insects. A large and useful exhibition of the North American flora, the result of fifty years of botanical study, search, and correspondence. A large and valuable collection of butterflies, appropriately mounted. The Hall of Natural History is under the charge of Prof. William John Miller, Ph.D., an eminent authority on geology and mineralogy. Dr. Miller recently wrote a treatise on "The Geology of the Remsen Quadrangle" including Trenton Falls and the vicinity in Oneida and Herkimer counties. This book was published by the University of the State of New York as Bulletin No. 126 of the Education Department.

DRIVING PILES WITHOUT A PILE DRIVER

BY GEORGE H. LODGE

It may be of interest to many of the readers of the SCIENTIFIC AMERICAN to learn of an easy method of driving piles through the ice without the use of a pile driver.

Those who have tried to drive even a small post by hand while working in water or from a small boat have found it much more difficult than one would at first suppose. I was myself confronted with the problem of building a dock landing for a lake steamboat—a steamboat built to carry 300 passengers, being 70 feet long. The problem was to build a dock or landing safe and large enough to handle the people rapidly.

First we thought that it would be necessary to hire a pile-driving outfit, but my father, R. H. Lodge, devised a plan that works to perfection.

We select straight white oak piles not over one foot in diameter at the butt which are cut to the length required, usually from 20 to 36 feet. These are sharpened at the butt ends to a point and with an ax a thread is cut from the point of the stick back from three to four and one-half feet, according to the size of the pile.

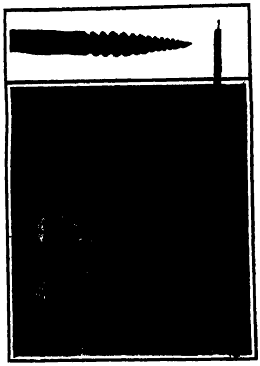
It is important that the threads be cut as nearly the same distance apart as possible. A good man with an ax can soon cut threads that are mechanical. It is astonishing how many, with a little practice, can be cut in a day. It pays to use special care in the cutting, as it helps wonderfully in the driving. Piles that are from ten to twelve inches in diameter should have threads from three to three and one-half inches apart and two to two and one-half inches deep.

After the threads are cut the pole is ready to drive, which is done by chopping a hole through the ice at the desired spot, being careful not to make the hole over two inches larger in diameter than the pole, and have the ice act as a guide to keep the pole upright while screwing it down.

If the pole is long and heavy, it is necessary to fasten three guy ropes to the top of it before raising. After the pole is raised, it is an easy matter to keep it plumb by pulling the ropes.

The pile is raised like a common telephone pole; in other words, a little at a time with pike poles, following up under with two planks spiked together in the form of an X.

It is a good plan to stand a plank in the hole and to let the point of the pile rest against it, as it assists in placing the pile in the desired spot.



DRIVING PILES WITHOUT A PILE DRIVER.

It is also a great help to spike a short plank across the pile, temporarily, just above the threads, to keep the pile from shooting under the ice before it is vertical, whereupon it may be knocked off. The pile will then drop into the proper place.

Now you are ready to bind a pole (or sweep lever) to the pile. This is done with a common log chain, care being taken to bind it so that it can be screwed in the right direction. Hitch a sharp-shod horse to the outer end and lead him around the pile (capstan fashion).

It is an easy matter now to screw a large pile from four to eight feet into solid clay or gravel or to unscrew it and remove it.

The accompanying photographs illustrate the wooden threads ready for use, and the plan of screwing in a left hand threaded pile by the aid of a horse. We often put in smaller poles by hand, using two or three men instead of a horse.

We have recently taken out two steamer tie posts that have been in use for eight years, having begun to decay. These unscrewed posts we found had been in sixteen feet of clay and quicksand. It was necessary to hitch the lever below the water line, where the wood was sound, in order to start them.

To the Cairo Scientific Journal for January last Mr. B. F. E. Keeling communicates an interesting paper on climate changes in Egypt. There is a strong belief among residents that changes have occurred within the last ten or twenty years (possibly due to increased irrigation) which are distinctly "sensible" without the aid of instruments. Mr. Keeling quotes the mean temperature at Abbassia for each pentade from 1870 to 1904, and for the four years 1905-8, but the results show that the differences are hardly greater than might be caused by difference of exposure of the thermometers. As regards humidity, also, there is very little evidence of any decided change during the last forty years. It is confidently asserted by many persons that the rainfall has increased during quite recent years, but the author shows that there is little, if any, evidence of such being the case. The total rainfall of any year is often influenced by the fall on a single day, and is consequently very variable from one year to another, the driest year on record at Abbassia is 1892, with little more than a quarter of an inch of rain, and the wettest, 1904, with less than 3 inches, the mean for 1887-1908 being approximately 1.4 inch.

AN ARTISTIC REINFORCED CONCRETE BRIDGE

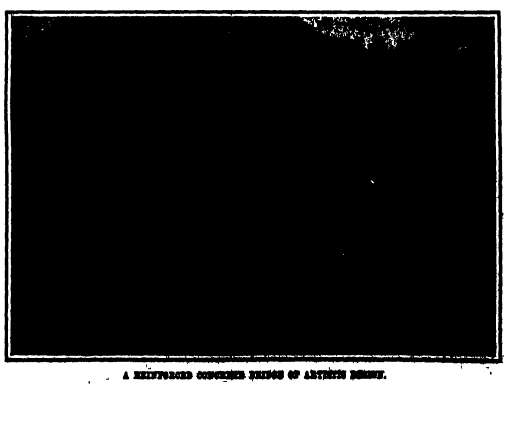
A COMING TYPE FOR COUNTY HIGHWAY BRIDGES

In country districts where the materials are readily accessible the reinforced concrete bridge should prove to be an ideal system for the construction of concrete bridges of moderate span. We say of moderate span, for the reason that the art of trussed bridge construction in reinforced concrete is as yet in too early a stage of its development to warrant its indiscriminate use in bridges of considerable span. In structures of moderate length, say up to about eighty or a hundred feet, if care is taken in proportioning the parts, especially at the joints, and very particular care is taken in securing a thorough bond between concrete and steel, the county commissioners or other authorities should find the concrete steel bridge a reliable and economical type. It is easy to erect, it requires no painting and practically no maintenance whatever, it is indestructible by fire or the action of the weather, and its subsequent cost for maintenance should be practically nothing at all.

The accompanying illustration shows a bridge of this class of the bow-string type which was recently built in Canada. It has a span of 80 feet and provides a clear roadway 16 feet wide. The total weight is about 160 tons, and it contains about 13 tons of reinforcement in the form of plates and round rods.

The bridge was designed to carry a load of one hundred pounds per square foot evenly distributed, and it was tested for this load with an additional load of 35 tons represented by a herd of 70 cattle.

On the score of appearance it must be conceded that the design is decidedly pleasing the intersection of the balustrade with the chord and web members having been worked out with considerable taste. The structure spans the Etobicoke River, in the counties of York and Peel, Canada.



A REINFORCED CONCRETE BRIDGE OF ARTISTIC DESIGN.

No sooner had the first modest attempts to steer ships by aerial electric waves been crowned with more or less success, than endeavors were made to direct the course of balloons and aeroplanes in the same manner. The American engineer Anthony has made experiments off Sandy Hook, with a small unmanned dirigible balloon, which he succeeded in guiding more than a mile seaward and bringing back to the point of departure. Prof. Wiechert suggests the employment of unmanned aeroplanes for the study of atmospheric electricity and has designed an apparatus of this kind. It is obvious that such an apparatus, equipped with the necessary instruments, which could be sent to great heights without danger and brought back with certainty, would be much more useful for the study of the atmosphere, and especially that of atmospheric electricity, than unmanned registering balloons, the recovery of which is always a matter of chance, or manned balloons and kites, the use of which is not unattended with danger in stormy weather. Balloons controlled from a distance by electric waves would also be very useful in the rescue of shipwrecked persons and for many military and other purposes. But—and this objection applies also to the wireless direction of ships and torpedoes—it is a long step from successful experiments in favorable conditions to uniform success in practical use.—Prometheus.

Instrument for Detecting Violations of the Speed Laws

BY L. GORDON GLAZIER

A very ingenious instrument for recording the speed and license number of an automobile has been devised by two instructors of the Massachusetts Institute of Technology. The instrument, which is but little larger than a pocket kodak, consists of a double camera with a watch movement which controls the operation of the camera shutter.

When an automobile passes at a speed that seems excessive, the operator trains the instruments upon it and releases the mechanism by pressing a button. Immediately the shutter of the upper camera is sprung taking a photograph of the receding automobile, and a moment later the other shutter is sprung, taking a second image of the automobile, whereupon the timing mechanism comes to a stop. The plate is developed by the regular process, and the resulting negative shows an image of the automobile near the operator with its license number distinct, and a second view of the machine taken at the end of the time interval. In the center of the print are the photographs of the hands of the stop watch caught when the first and second exposures were made.

DOUBLE CAMERA WITH WHICH VIOLATIONS OF THE SPEED LAWS ARE DETECTED.

Since the automobile has traversed a certain space in the time interval, the second image is smaller than the first by an amount which can easily be measured with an ordinary scale, divided in hundredths of an inch; and knowing that the standard wheel tread is 56 inches, the distances of the two objects from the camera and hence the space the automobile has covered in the time interval is easily found by the following law. The distance of any object from the lens is as many times greater than the focal distance of the camera as the length of any line of the real object is greater than its length in the photograph. This is a simple proportion in which three of the terms are known, namely, the size of the object, the size of the image of the object on the plate, and the distance of the image from the lens. The fourth term of the proportion, the distance of the object from the lens, follows by simple division. However, the operator is saved all irksome computation by a table attached to the instrument.

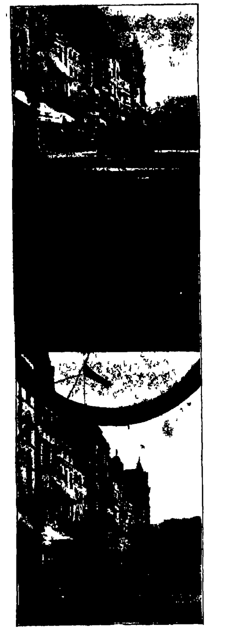
To overcome the possible objection by the courts, the watch has been designed so that the operator of the instrument may actually see it during the process of taking the picture. This is made possible by simply boring a hole from the outside of the camera box to the back of the watch, which brings to view a dial around which travels a hand attached to the same pinion or staff as the regular hand of the watch. In order to see this dial more plainly, two mirrors have been placed permanently in such a manner as to illuminate it.

The instrument gives extremely accurate results, and can be calibrated from time to time on objects of known speeds.

The inventors believe that the instrument should be welcomed by autoists as well as police. It is an impartial judge, the personal element being entirely eliminated. A motorist who has been stopped does not have to rely on an officer's estimate of the speed, nor on the speed claimed by the officers operating a trap by means of stop watch and signals. Dozens of motorists are fighting cases every day who honestly believe that they were not overspeeding when stopped. They would be perfectly willing to pay their fines if convinced they were violating the law. Even where the more rational view is taken that the speed alone shall not determine whether or not a man is violating the law, but that the speed taken in connection with the surroundings shall determine it, it is always a question of the officer's word against the autoist's as to surroundings. This photographic speed recorder shows whether there were several vehicles near the automobile, whether people were crossing the street, whether it was more than ordinarily dangerous to run at the speed indicated, or more than ordinarily safe.

A great advantage of the instrument is that it records speed over a short distance. In the congested portions of cities, near crowded cross streets and in similar situations, it offers the only existing method of measuring momentary bursts of speed. The record of any reckless driver can be easily obtained and a print sent directly to him, when he cannot deny the evidence of his own eyes, and in many cases an arrest will not be necessary, as the offense will not be repeated.

Regarding the legality of this speed recorder in a recent case that was strongly contested Judge Hammond of the Massachusetts Supreme Court said "The result of the evidence did not depend upon the fluctuations of human agencies nor on conditions where relations to results were uncertain, but upon the immutable working of natural laws, and upon the evidence the presiding judge may well have found that such experiments were likely to be more reliable as to the speed of the automobile than the conjectural statement of an eye witness or the interested statement of a chauffeur."



SPEED OF AN AUTOMOBILE SHOWN BY TWO CONSECUTIVE PHOTOGRAPHS

Sacrificial Compliments Paid to New Buildings in Antiquity.

A superstition that still envelops a great part of the earth is that especial firmness may be given to a building and that it may be protected from hostile influences by inclosing a living creature, preferably a human being, in one of the walls of the building itself. This belief, which is particularly prevalent in the Balkan peninsula and, for instance, has given to the Roumanian Queen, Carmen Sylva, material for one of her most beautiful folk tales, has not been known as having had any hold in Italy hitherto. Recently, in the course of archæological research, it was found that in the foundation of the Temple of Fortune in Pompeii there was a hollow space in which nothing other than the shell of a tortoise was found which time had broken into four pieces. Here, consequently, was proof of the precise immurement of a tortoise, which was enhanced by the disposition of the square blocks of stone of the creature's prison. In Italy this superstition may have passed at an early day into oblivion, as the sacrifice of human beings was foreign to the Roman religion, and was practised occasionally only under Greek influence. As, however, the sacrifice of human beings among the old Greeks was not unusual, and in Greece, as well as in the adjacent countries the tradition of sacrifice to new buildings is still insistent, it may be believed that in old Greece also the sacrificial compliment to new buildings was not unknown. Instances of this kind of sacrifice in antiquity are certainly not frequent, all those of which we have any knowledge are attributed to the Greek Orient. Usually a maiden was sacrificed who, at the same time, became the guardian spirit of the structure. For this reason Trajan effected the erection in the theater at Antioch of the statue of the girl who has been sacrificed on the occasion of the reconstruction of the city after an earthquake and was designated as Tyche, the Goddess of Fortune of the scene of her sacrifice. It is this idea which still lies to-day at the root of this superstition of sacrificial compliment. Solidly a human being is incased in a wall of a house or other building, so that its soul may live in the structure and never escape from it. At the present day a vicarious sacrifice takes the place of such immolation. The human sacrifice is practised symbolically only, either by taking the measure of a person, or of the shadow, and immuring the string representing the measure or by incasing in the wall an animal already killed or still alive. Manifestly such a vicarious sacrifice is the tortoise of the Pompeiian temple, and probably the tortoise was selected because this animal can live a long time without nourishment, and the builders believed that the charm was more effective the longer the entombed creature lived.

The Hangman's Rope.

When death is caused by hanging what proportion does the pull to which the rope is subjected during the struggles of the victim bear to the weight of the body? This novel question has been asked and answered by experiment by Dr. Angelo de Dominicis. The tension in each case was measured by a dynamometer attached to the rope. A living dog, suspended in such a manner that it remained quiet, exerted a pull of 20 pounds, but the subsequent "hanging" of the same animal produced a pull of 42 pounds. With a larger animal the corresponding tensions were 50 pounds and 103 pounds.

Hence it appears that the convulsive movements of the victim may increase the tension of the rope to more than twice the weight of the body. This result explains the occurrence in the bodies of persons killed by hanging of serious lesions which it would be difficult or impossible to produce by hanging up a corpse. The strength of the rope must also be taken into account. If a body is found suspended by a rope the breaking strength of which is little greater than the weight of the corpse, it may fairly be inferred that the body was not suspended until after death. Hence the experiments furnish valuable data for determining the cause of death in such cases and will probably be made use of in some future detective story.

JUPITER AND HIS SATELLITES

BY PROF. FREDERIC R. HONEY, TRINITY COLLEGE

Jupiter and his satellites command especial attention at the present time, owing to the fact that this greatest of all the planets and second only to Venus in brilliancy, is approaching opposition which will be reached on March 30th Jupiter will then be both morning and evening star

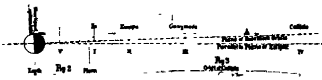
The comparatively recent increase in the number of Jupiter's satellites from four to seven and possibly eight as revealed by the growing power of the telescope directs the astronomer's curious scrutiny upon the Jovian system The satellite which is nearest the planet revolves around its great primary in the short space of twelve hours, at a distance of only 68,400 miles from the surface, while the outer most moon shows its extreme remoteness from its center of attraction (the enormous distance of 7 430 000 miles) by a revolution requiring 265 days Thus is exemplified a perfect conformity to Kepler's laws A small magnifying power reveals the elliptic outline of Jupiter, whose polar depression is extremely marked the equatorial and polar diameters showing a difference of over 5000 miles

In the plot of the orbit Jupiter's position is shown for the date of opposition, which is very near aphelion, also for the oppositions from 1902 to 1911 inclusive The average interval between oppositions is 399 days. But, in obedience to Kepler's second law, the planet's velocity at aphelion is diminishing. The last opposition occurred on February 28th, 1909, and the next will occur on April 30th, 1911 At perihelion the velocity was accelerated The dates of the oppositions, which occurred before and after the perihelion passage were respectively September 11th, 1903, and October 18th, 1904

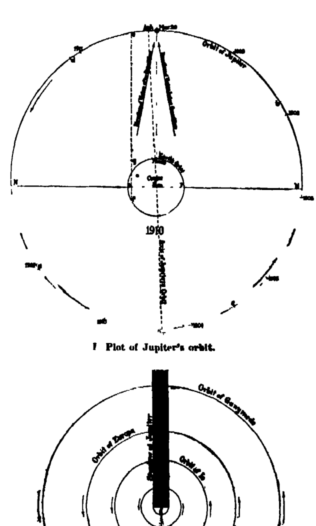
The five inner satellites revolve in orbits whose planes very nearly coincide with that of Jupiter's equator This plane forms a small angle with the ecliptic, and may be represented approximately by a straight line (Fig 1) The distances from Jupiter to the satellites are represented by the same scale as the planet It is impossible to show the positions of the two outer satellites by this scale within the limits of this page, since their distances from Jupiter are over six times that between the planet and Callisto. It should be noted that all the satellites are never on the same side of the planet at the same time, as shown in the figure This view of the satellites' orbits is obtained when Jupiter reaches the positions A and B shown in the plot of the orbit. When Jupiter is near either of these points, the five satellites appear to move back and forth in straight lines, and at every revolution of each satellite there is alternately a transit across Jupiter's disk and an occultation by the planet Fig 1 shows Jupiter and the orbits as seen from the earth in 1908 In 1902 this figure was reversed During Jupiter's revolution around the sun in 11 86 years, the planet and the satellites are continually changing their positions relative to the ecliptic The plane of the orbit is inclined at an angle of 1 3 deg, and that part which is above the ecliptic is represented by the full line The line joining the points N and N^1 (the ascending and descending nodes) is the intersection of the plane of the ecliptic In Plot 1 a visual ray A from the earth tangent to the planet shows that, seen in this direction, Callisto is no longer occulted by Jupiter Between the positions A and C, and between B and D, the orbits very gradually open out to the elliptic form, and at C and D the length of the minor axis reaches its maximum

Fig 3 represents the orbit of Callisto when the satellite no longer suffers occultation by Jupiter Cessation of occultations evidently begins some time before the date when the eclipse opens to its maximum width. But the diameters of the orbits of the four inner satellites are smaller, and with them transits and occultations continue There will be no occultation or transit of Callisto or its shadow this year after January 25th On this day the shadow was projected on Jupiter between 9 h 11 m and 10 h. 5 m. In the plots of the orbits of Jupiter and of the satellites the general directions of the lines of vision from the earth before and after opposition are indicated by arrows.

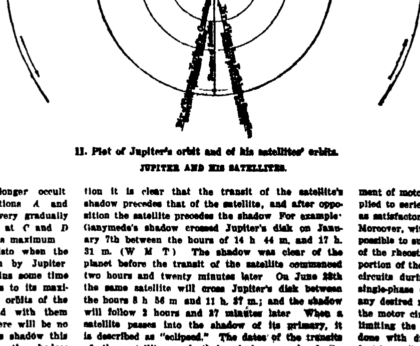
Obviously the planet does not occupy the same position in its orbit as that shown in the plot before and after opposition But if this page be rotated clockwise and counter clockwise through small angles, one position will represent Jupiter in his orbit before, and the other that after opposition Before opposi-



Relative positions of Callisto, Jupiter and the Earth.



I Plot of Jupiter's orbit.



II. Plot of Jupiter's orbit and of his satellites' orbits.

JUPITER AND HIS SATELLITES.

tion it is clear that the transit of the satellite's shadow precedes that of the satellite, and after opposition the satellite precedes the shadow For example Ganymede's shadow crossed Jupiter's disk on January 7th between the hours of 14 h 44 m, and 17 h. 31 m. (W M T) The shadow was clear of the planet before the transit of the satellite commenced two hours and twenty minutes later On June 28th the same satellite will cross Jupiter's disk between the hours 8 h 56 m and 11 h. 37 m.; and the shadow will follow 2 hours and 27 minutes later When a satellite passes into the shadow of its primary, it is described as "eclipsed." The dates of the transits of the satellites and their shadows, and of the eclipses and occultations, are given in the Nautical Almanac for ten months. For one month before and after conjunction (October 18th) when Jupiter's proximity to the sun will be too close for observation, the phenomena of the satellites are omitted.

Observations of the occultations of Jupiter's satellites provide a valuable means for verifying the velocity of light. As the earth recedes from Jupiter after opposition, an occultation is observed to occur after a longer interval of time than that which would elapse if the planets were separated by a constant distance, and after conjunction, when the earth is approaching Jupiter, the intervals are observed to diminish Light crosses the earth's orbit in a little less than a thousand seconds $\frac{185,800,000}{186,330}$ = 16 m. 37 s. At the date of opposition this year Jupiter's distance from the earth is 413.8 million miles. Occultation of a satellite at this distance is observed on the earth $\frac{413,800,000}{186,330}$ seconds, or 37 minutes after its occurrence. The points e and f are respectively the positions of Jupiter and the earth at the same date when the projection on the plane of the ecliptic of the line connecting the planets is parallel to that of March 30th At the second date, when the earth is at f, observation of a phenomenon of Jupiter's satellites occurs later than would be the case if the earth remained at the constant distance (ge) from Jupiter, and the difference in time is that represented by the interval gf, or $\frac{gf}{AP}$ × 997 seconds.

A comparison of the earth and moon with Jupiter's satellite system is shown in Figs. 1 and 2, which are drawn to the same scale. The moon's distance from the earth does not differ very much from Io's distance from Jupiter The revolution of the latter is accomplished in 1 77 days, and of the former in 27 32 days. If Io's distance were reduced to correspond with that of the moon from the earth, the period of the satellite would be even shorter than that which is given in the table The rapid revolutions of the planet's satellites maintains them in their orbits in opposition to the great central force attracting them to Jupiter, whose mass is 318 times that of the earth In the table the diameters of satellites V, VI, and VII are not given They are too small for accurate measurement, the diameters ranging from 50 to 100 miles.

JUPITER'S SATELLITES.

Name	Distance, Miles.	Period, Days.	Diameter, Miles.
V	112,500	0 5	
Io..	261,000	1 77	[illegible]
Europa	415,000	3.55	[illegible]
Ganymede.	[illegible],000	7 15	[illegible]
Callisto.	1,167,000	16 69	[illegible]
VI ..	7,155,000	[illegible] 4	
VII	7,405,000	[illegible].0	....

That the controlling devices for a single-phase car equipment need not be more complicated than for a direct-current car, states the Electrical World, will be apparent at once from the fact that any of the methods now used with the latter type of car can be applied immediately to the former without alteration. It it evident that by selecting a suitably low value of trolley E. M. F the familiar series-parallel arrangement of motors with rheostatic acceleration can be applied to series motors of the single-phase type equally as satisfactorily as to those of the direct-current type. Moreover, with the alternating-current equipment it is possible to substitute reactance coils for the resistance of the rheostats, and thereby eliminate a considerable portion of the energy dissipated as heat in the control circuits during acceleration In addition, with the single-phase car there can be obtained, conveniently, any desired number of voltages to be impressed upon the motor circuits, and there is thus no necessity for limiting the E. M. F. to a single value, as must be done with direct-current equipments. To this latter fact is attributable the essential difference between the controlling circuits of single-phase and direct-current cars.

Correspondence.

A REMARKABLE PHENOMENON.

To the Editor of the SCIENTIFIC AMERICAN

I have just read with interest on page 138 of the SCIENTIFIC AMERICAN of the "remarkable phenomenon" observed by Mr. V. J. Laine, in which a rainbow was seen to be disturbed after each peal of thunder Mr Laine's explanation, based upon the change of size of the rain-drops, is apparently unwarranted, inasmuch as according to the old and generally accepted optical theory of the rainbow, the angular position of the colors of the bow relative to the direction of the sun and the observer's eye, is independent of the size of the rain-drops.

To the writer the phenomenon is more plausibly explained by recognizing the atmospheric disturbance in the line of sight of the observer due to the thunderbolt. The light, after dispersion by and reflection from the rain-drops, passes through air which is agitated by the concussions following the lightning strokes, and the intense sound waves radiating therefrom The result is similar to that seen over a hot surface, as a stove or heated field, where the convection currents distort the light rays traversing the overlying air.

While it is true that ordinary sound waves do not affect the density of the air sufficiently to deviate the course of light perceptibly, the violent expansion and contraction accompanying a thunderbolt may produce the result. The peculiar circumstance in the case referred to is that the storm approached from the east, opposite to the sun, so that the lightning discharges, which are generally in the advance portion of the storm cloud, occurred in the vicinity of the observer and between his eye and the apparent position of the rainbow, whereas ordinarily when a rainbow is seen in the east it is after the storm has passed over and the lightning is taking place in the distance beyond. W. H. HOWARD.

Washington, D. C.

THAT CURIOUS WATER PHENOMENON.

To the Editor of the SCIENTIFIC AMERICAN

I observed a similar curious phenomenon to that reported by James S. Lee in your issue of January 29th Mine was observed from a train going west through the great Alkali Desert in Nevada. The desert floor is of sand, and flat, as though laid by water Innumerable desert or beach grass mounds covered perhaps ten per cent of all the surface. These mounds or dunes vary from six to twenty feet in diameter by one to two feet high

It was about five o'clock of a warm September afternoon I noticed, looking westward and nearby, what seemed to be a small but powerful stream of water or fountain, going to perhaps twenty-five feet in height. Close observation revealed many hundreds of these fountains. As near as I could make out, there was one from the center of each of the sand dunes, varying in size much as the sand dunes varied in area. These fountains were really formed by incipient cyclones carrying sand, not water, in small streams, somewhat in the shape of slender long-waisted hour-glasses, spreading at the top to fall to earth. These varied from twenty to fifty feet high. The train was making the usual rather slow desert time, which gave a fair chance for observation. This continued for ten miles along the line What caused them? I suppose the floor of the desert was several degrees cooler than the sand dunes, which had been absorbing solar heat rapidly all day As evening approached, the warmer air over the dunes rose rapidly, assuming the natural spiral motion, licked up warm dry sand, and made a most beautiful picture. The passengers gazed and wondered why.

Will the Editor please give the correct cause if mine, as given, is incorrect?

San Francisco, Cal. ROY T KIMBALL.

WANTED: AN ELECTRICAL APPARATUS FOR LOCATING SUNKEN TREASURE.

To the Editor of the SCIENTIFIC AMERICAN

I have been unsuccessful in finding in England any manufacturer of an improvement upon the under-water electrical ore-finding apparatus originally described in the SUPPLEMENT of your paper dated January 20th, 1906.

I am attempting to locate the position of the hull of a wooden ship about 120 feet long by 40 feet beam, which has on board forty-four cannon and a considerable quantity of cannon ball, aggregating approximately about 20 tons in weight. The ship is also believed to contain a number of silver and copper coins. The hull is covered by about 20 feet of sand and mud, and she lies in about 70 feet of water, in an extremely sheltered bay. Her position is known to within 100 yards. As the vessel belonged to the Spanish Armada, she possesses considerable historical interest. I desire to get into communication with some one who would be able to construct any improvements upon the instrument described in your SUPPLEMENT of the above-mentioned date, and who would give a preliminary test of the apparatus, to show that it could fulfill the working conditions necessary I would also like to know the cost of the instrument.

KENNETH MACKENZIE FOSS, Lieutenant Colonel

London, S. W

The Wisps of Saturn.

In a recent bulletin, Prof Percival Lowell of Flagstaff, Ariz., announces that on September 19th, 1909, in examining Saturn he noticed what seemed to be faint lacings traversing diagonally the planet's equatorial belt Not only was the phenomenon unprecedented, but it was so faint and illusive that he was unable at first to assure himself of its objective reality On mentioning his impressions to his assistant, Mr E C Slipher, he found to his surprise that he had had suspicion of the same thing on September 9th, and had even thought to detect traces of it on the photographs of Saturn taken by him afterward on that day At the same time that Lowell divined rather than described the wisps he saw unmistakably a fine dark irregular line running longitudinally through the middle of the bright equatorial belt, a line not of uniform character, but as if composed of beads strung upon a wire.

Following up the eye-hint thus vouchsafed he examined the equatorial belt for the wisps at moments of good definition during the succeeding days. Repeated observation of them, both by him and his assistant, eventually showed them to be facts, and then, to clinch the matter, he succeeded in getting, on November 4th, some excellent photographs of the planet in which they stood recorded, appearing *in situ* in successive images on the same plate

The manner in which the photographs are taken enables one to eliminate on the images imperfections due the apparatus from features due the planet itself, for not only is the plate moved first horizontally and then vertically for the successive images, but the color-screen through which the photographing is done is itself shifted at intervals during the taking of the plate Nothing due to either cause could, therefore, perpetuate itself *in situ* on images of the set some distance apart

On the photographic plate the images appear exactly as they do to the eye, though of course not so well defined, to wit as wisps or filaments, fainter than the dark belts of the planet's disk, crossing the bright equatorial belt. Like all astronomic phenomena previously unperceived, they became much easier to catch after their presence was known, their recognition not being nearly so difficult as their discovery Their apparent lack of contrast with their surroundings is for much in this, which is also why the photographs which intensify contrast brought them out.

In look the lacings resemble faint shreds of some dusky substance in the act of dropping from points on one edge of the bright belt over to the other Though darker than the bright belt, they are much lighter than the dark belts from which they come a difference in tone which is probably due to their real slenderness being spread out by the light waves and so thinned in strength.

Careful scrutiny revealed that the wisps started from triangular spots in the dark belt, and Mr G R Agassiz, who was observing with Prof. Lowell, detected that the adjacent parts of this belt were themselves crisscrossed by darker lines. The triangular spots are not difficult, giving the edge of the belt in good seeing a notched or toothed appearance It has not been possible as yet to use the wisps for timing the rotation periods of Saturn's equatorial region, owing chiefly to their number and the confusion consequent upon it, but identification will undoubtedly come in time and give us a more accurate value of the equatorial speed than we at present possess.

Interesting as the lacings are in themselves, they become doubly so from this fact, that they almost precisely parallel the phenomena recently discovered on Jupiter, in the same regions. Except for faintness, which Saturn's greater distance both from the sun and from us alone would cause, the one set of features is almost a replica of the other. Like the Jovian, the wisps seem to be more tenuous in the middle of their course. Like the Jovian equatorial phenomena, too, the medial core is more conspicuous than the wisps.

The Saturnian lacings cross the equatorial belt usually at an angle, but one which is less than that of the average of the Jovian ones. This angle should have something to say about the factors concerned in the formation of the two sets respectively; for analogy is best explained by secondary difference.

Official Meteorological Summary, New York, N. Y., February, 1910.

Atmospheric pressure Highest, 30.73, lowest, 29 43; mean, 30 12 Temperature Highest, 59, date, 28th, lowest, 2, date, 7th, mean of warmest day, 54, date, 28th, coolest day, 11, date, 7th, mean of maximum for the month, 37 6, mean of minimum, 25 1, absolute mean, 31 4, normal, 30.7, daily excess compared with the mean of 40 years, 0.7 Warmest mean temperature of February, 40, in 1890; coldest mean, 23, in 1875-1885 Absolute maximum and minimum of February for 40 years, 69 and — 6 Average daily excess since January 1st, 1 4 Precipitation 4 07, greatest, 1 57, date, 28th, average for February for 40 years, 3.80 Accumulated excess since January 1st, 2 08 Greatest precipitation, 7.81, in 1893 least, 0 82, in 1895 Wind Prevailing direction, West, total movement, 9,679 miles, average hourly velocity, 14 4, maximum velocity, 45 miles per hour Weather Clear days, 8, partly cloudy, 10, cloudy, 10, on which 0 01 or more of precipitation occurred, 9 Snowfall 5 3 Mean relative humidity, 65 5 Sleet, 9th, 12th Dense fog 21st. Mean temperature for the winter, 31 73, normal, 31 80, deficiency, 0 07 Precipitation for the winter 14 68, normal, 11 03 Excess, 3 65 Total snowfall for the winter, 33 3

Ephemeris of Comet A 1910.

A letter has been received at Harvard from Capt. T E. De Witt Veeder, Superintendent U S Naval Observatory, giving the following elliptic elements and ephemeris of Comet A 1910, computed by Prof. H R. Morgan

"Numerous direct solutions having failed, the distances for Washington observations January 25th and February 4th were varied to get the following elements. A slight change in the elements carries the comet near Mercury January 19th, and near Mars last year"

ELEMENTS

Epoch = 1910, January 20 5d Gr M T			
M	mean anomaly at epoch	= 7° 46'	
π	= longitude of perihelion	105 30'	Ecliptic 1910 0
Ω	= longitude of node	66° 16'	
i	= inclination	137° 9'	
ϕ	= angle of eccentricity	= 66 15'	
Log a	log mean distance	0 1500	
Log μ =	log. mean daily motion	3.3116	

(O-C.)

	Jan 18	Feb. 2	Feb 10
$\Delta\lambda$	8 0m	+2.1m	+0 8m
$\Delta\beta$	−3 1m	+6 2m	−4 2m

EPHEMERIS

Gr M T		H	M	S	δ		Log r	Log Δ
1910.	February 26 0d	22	12	46	+1 8°	9'	0 2810	0 0289
	March 2 0d	22	16	26	18	4'		
	March 6 0d	22	20	21	18	50"		
	March 10 0d	22	23	25	+11	45'	0 3707	0 0998

The Current Supplement.

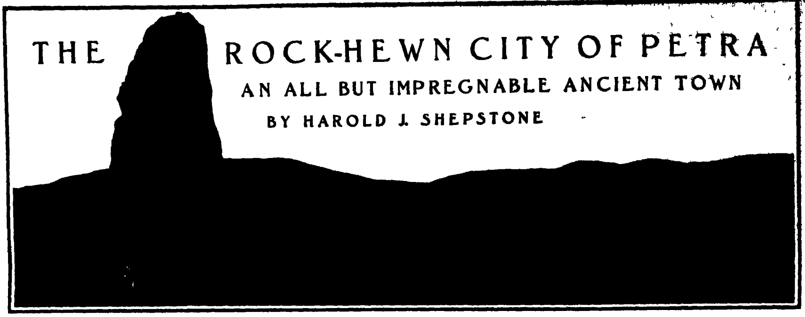
A new process for reducing atmospheric nitrogen, invented by Dr Schonherr is described in the opening article of the current SUPPLEMENT No 1784 Among the present wonders of science none stirs the imagination so powerfully as the doctrine that some forms of insanity are the result of a chemical change in the blood The theory is elaborately discussed in an article entitled, "The Chemistry of Insanity" The recent development of aeronautics has suddenly created a demand for large quantities of hydrogen at a low price The subject is considered in a short article Emil Kosack writes an article on speaking magnets, speaking iron, and speaking wire Since the experimental bombardment of the "Belle Isle" of the British navy, no such thorough and systematic firing tests have been directed against a warship in any foreign navy as those of which the French warship "Jena" was the subject last year An elaborate article by a competent authority gives the results of the tests. W P Dreaper exhaustively reviews the artificial silk industry One of the most recent important events in the field of prehistoric archeology was the discovery of a megalithic monument of remarkable size in Bisceglie Italy This subject is discussed in an illustrated article In the middle ages falconry, or hawking, was regarded as the king of sports, as it was the sport of kings The origin and development of this obsolete form of hunting is discussed by Dr Hans Bollmer in an article entitled "Falconry in the Middle Ages" Perhaps the most distinguished authority on the subject of precious stones in Germany is Prof M Bauer of Marburg He contributes an exhaustive article on artificial stones which contains a wealth of technical information The process of directly producing ammonia from coke-oven gas is described Since Davy, nearly a century ago, constructed the first safety lamp, inventors almost innumerable have produced lamps bearing their names but in the majority of instances the alleged improvements have been more apparent than real A comparative estimate of the safety of these various forms of miners' lamps is presented by J B Marsaut F W Henkel contributes an article on astronomy and astrology, in which he riddles the supposed influence of the planets upon human affairs

After three successful flights on March 2nd, Lieut. B. D. Foulois in a Wright aeroplane, made a fourth attempt at San Antonio which resulted disastrously The rudder of the machine was wrecked and Lieut Foulois had a narrow escape from injury The machine had just turned the southern end of the parade field at Fort Sam Houston when the engine stopped The aeroplane fell forty feet to the ground

THE ROCK-HEWN CITY OF PETRA

AN ALL BUT IMPREGNABLE ANCIENT TOWN

BY HAROLD J. SHEPSTONE



The rock-hewn obelisks of Petra.

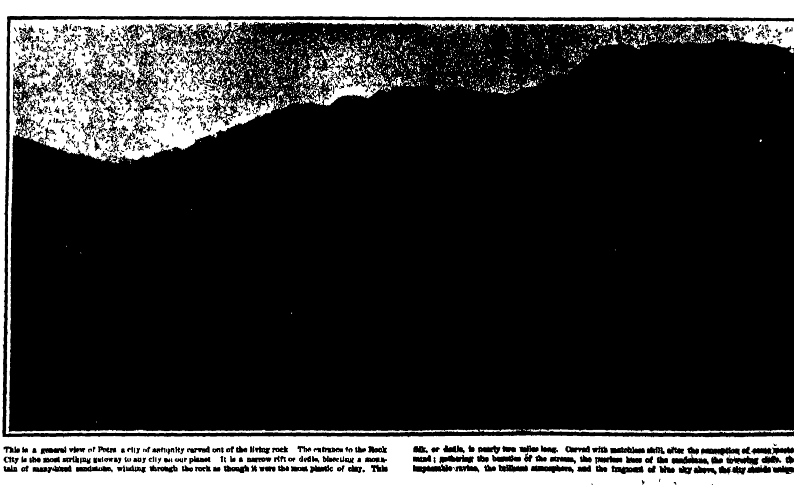
The view is taken high up to the south of the narrow valley called the Wady Mousa (the Vale of Moses) in which the famous rock-cut city of Petra reposed in ancient times, securely shut in from attack of the marauding desert tribes. It is on what bears the name of the Mountain of Obelisks, so called from the huge monolith pillars that have been made with incredible toil by cutting away from all around them the mountain top. Their height can be judged by comparison with the figure of a Bedouin standing by one of them. They are evidently Egyptian in their conception and design, as also are many of the pylons and temples of Petra.

Unique among the many wonders of the Orient and the remains of hoary civilizations stands Petra the rock hewn city the city so graphically addressed by the prophet as Thou that dwellest in the clefts of the rock, whose habitation is high (Obad 3), and referred to in the challenge of the Psalmist (60 9) "Who will bring me into the strong city? Who will lead me into Edom?" It lies on the northwest edge of the great Arabian desert about midway between the Gulf of Akabah and the Dead Sea. Other ruins such as Palmyra and Baalbec, show crumbling piles of magnificent architectural monuments but in Petra, high up among the mountain crags that sentinel it, are temples theaters, tombs, and other structures, strong and indestructible, standing almost as perfect as when they were chiseled out of the living rock of which they still form a part.

These ruins (if ruins they may be called) challenge admiration by the variety of styles they embody, showing, in the most ancient creations early native art intermixed with Egyptian and in the later magnificent edifices the best types of Greek and Roman architecture, and by the exquisite hues of the sandstone from which they were hewn, varying from the prevailing purplish red of the mountains and cliffs to the delicate pink and rose color of some strata, and the white crimson yellow and blue-ribboned veins in other places, rivaling the softness of the plumage of birds or the petals of flowers.

Petra, so long inaccessible because of its remoteness and the danger from roving Bedouins, may now be reached by a six hours' ride westward toward the Arabah from El Maan, a station on the new Mecca railroad. Prof Gustaf Dalman, director of the German Archeological School of Jerusalem and the author of a monumental work on Petra, has just paid another visit to this scene of his former explorations, in which he was accompanied by photographers of the American colony in Jerusalem, who secured a number of photographs of these majestic ruins, some of the most striking of which we here reproduce for our readers.

Petra nestling amid its precipices and cliffs almost in the shadow of Mount Hor, called by the natives Jebel Harun (Aaron) from the tradition that it was here on the top of the mount that Aaron died, is approachable only from the east through a deep and narrow defile which the little stream of the Wady Musa has in past ages cut for itself in the red sand stone. The gorge opens in one place to about two miles in width for a distance of about a mile, and here, protected by mountains and precipices on every side, this remarkable town lay secure from attack from without. It was its impregnable position and its being on the great caravan route to the Red Sea from the north that gave it the importance it had as a trade depot and stopping place. The approach was beneath a grand arched portal at the mouth of the Sik (as the deep ravine is called), some remains of the portal being still visible. It takes half an hour to follow the windings of the narrow path along the dark ravine, which is only from 10 to 20 feet wide, threading the course of the oleander fringed stream bed until one emerges into the small open valley. The variegated sandstone rocks rise precipitately on either side to the height of from 100 to 165 feet, almost shutting out the light of day. One of our views shows the entrance to the Sik. Another is taken about twenty minutes in from the opening, giving a good idea of the narrowness of the defile and the precipitousness of the rock walls, while beyond, where the gorge widens a little, are seen the sculptured columns of the magnificent so-called Khaznet el Farioun (the Treasury of Pharaoh) although it is one of the latest of the rock hewn monuments of Petra being attributed to the Emperor Hadrian who visited the place in A D 131 and erected here a temple to Isis. Another of our photographs shows this imposing structure, which is justly regarded as one of the wonders of the East. The rock wall from which it is hewn is here an exquisite rose pink. It is in a state of remarkable preservation. The imposing façade shows two rows each of six majestic columns one row above the other, with niches in which are rock-



This is a general view of Petra a city of antiquity carved out of the living rock. The entrance to the Rock City is the most striking gateway to any city on our planet. It is a narrow rift or defile, bisecting a mountain of many-hued sandstone, winding through the rock as though it were the most plastic of clay. This Sik, or defile, is nearly two miles long. Carved with matchless skill, after the conception of some master mind; gathering the beauties of the stream, the peerless hues of the sandstone, the towering cliffs, the impassable ravine, the brilliant atmosphere, and the fragment of blue sky above, the city stands unique

PETRA: AN ANCIENT CITY CARVED OUT OF A MOUNTAIN OF SANDSTONE AND ENTERED BY A MYSTERIOUS RIFT TWO MILES LONG.

The theater among the rock-cut ruins of Petra.

Ed Der, one of the most remarkable of the temples and tombs of Petra.

hewn equestrian and other statues the whole terminating above in a miniature temple crowned by a huge urn, the entire height being about 65 feet Within is a bare lofty room and some chambers.

A short distance beyond one emerges into the mountain guarded valley in which the city lay, mounds of debris marking the sites of the former homes of the Petrans, the population in the city's palmy days being estimated at from forty to eighty thousand souls The rock hewn structures chiseled in the precipitous cliffs on every side were public buildings and tombs rather than dwellings Just on the left, as the valley is entered is the vast rock-cut theater in semicircular form, capable of holding 3 000 spectators Here the workmanship is Greek. There are thirty-three tiers of seats In this locality are some of the oldest tombs, including detached pylons Many of the oldest tombs were cut away when the theater was hewn out of the mountain side. One of our photographs is of the theater

Standing in this small open valley one sees the façades of tombs and temples of many styles and dimensions with many niches for votive offerings They are at all elevations, many low down on the mountain side, and others high up in the cliffs, with stairways cut in the rock to reach them While most of them stand out conspicuously others are hidden in the mountain recesses and lateral valleys How eloquent are these silent pylons and obelisks of Edom and Egypt, and these columns and capitals of Greece and Rome! What diverse peoples these tombs have looked down upon when living and given sepulture to when dead! And how many different religions have been represented by ministering priests at these shrines!

One of our photographs is of a tomb or temple in three stories cut out of the mountain wall on the east and showing a succession of similar buildings beyond The façade of this tomb is not like most of the others in imitation of a temple, but of a lordly palace and it has been considerably damaged

On the opposite side of the valley to the west stand the remains of a masonry edifice called by the natives Kasr Farioun (the Castle of Pharaoh), of which we also give a photograph It was a Roman heathen temple

Behind the Kasr Farioun a rock-cut staircase leads up the rugged hill of the Acropolis to the Place of Sacrifice with its altars, pool, and court, all hewn out of the living rock This was a typical holy place, or "high place," of the primitive

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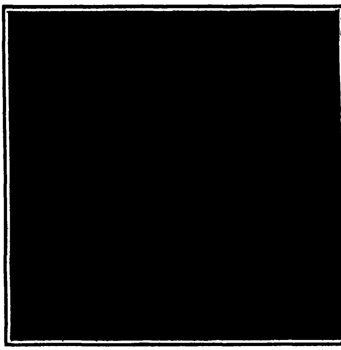
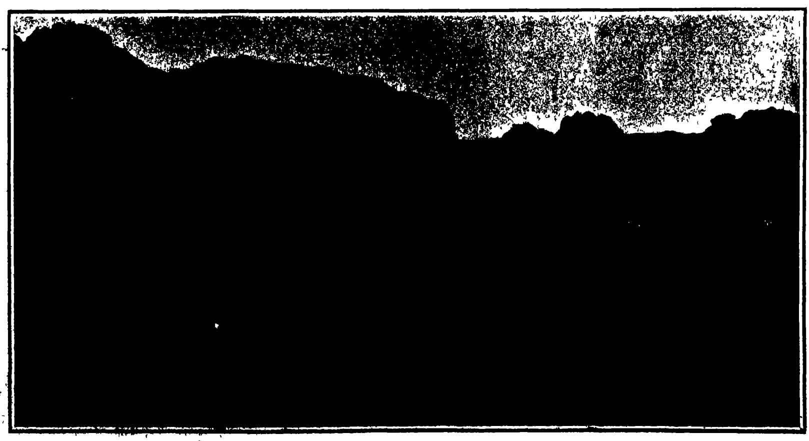


The Sik, the entrance to Petra, the impregnable rock-hewn city of antiquity.



among the ruins of antiquity. Amid the stupendous walls of rock which encircle this ancient habitation, and mark how man himself, but an imitator of Nature, has adorned the winding bases of these encircling walls with all the beauty of architecture and art—with temple, tomb, and palace, column, portico, and pediment—while the mountain summits present Nature in her wildest and most savage forms, and among the ineffaceable impressions of your soul will be the memories of this silent, beautiful "rose-red city half as old as time."

PETRA: AN ANCIENT CITY CARVED OUT OF A MOUNTAIN OF SANDSTONE AND ENTERED BY A MYSTERIOUS RIFT TWO MILES LONG.

AN ELECTRICAL FEVER RECORDER

BY DR. ALFRED GRADENWITZ

Fever, i. e., the rise in blood temperature attending certain maladies is known to be the outcome of a spontaneous reaction on the part of the body against the microbes invading it. The opinion is therefore, erroneous that fever in all cases should be acted against in order thus to subdue the morbid state of the patient. Nevertheless it is of the highest importance that the physician be kept informed of the variable temperature of the blood.

According to present practice temperature readings are taken at regular intervals, say three or four times a day by a sensitive thermometer. This practice obviously gives no information as to those oscillations in temperature which may have occurred in the meantime and which, in some cases, it would be desirable to know. A process allowing this important factor to be recorded continually and automatically therefore is worthy of universal attention. A firm of Berlin constructors, Messrs. Siemens & Halske, have recently perfected an apparatus achieving this result.

The apparatus is based on a very simple principle, viz. the alteration in the electrical resistance of platinum wire by variations in temperature. It comprises in addition to a coil of platinum wire a Wheatstone bridge and a self-recording millivoltmeter.

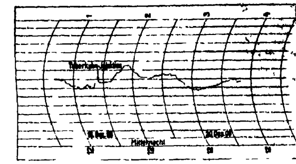
The platinum coil is either introduced into some of the cavities of the body or fixed on the body. A double conductor of low resistance connects the coil with the bridge and millivoltmeter, which records any variations in the resistance of the platinum wire and accordingly the temperature of the body.

The current required to feed the apparatus is supplied by a small storage battery of four volts, the gradual drop in tension being compensated for in a simple manner by means of a testing and regulating resistance with coarse and fine adjustment. As the normal range of the recording apparatus comprises the interval between 30 deg. and 45 deg. C. the curves registered are of sufficient distinctness for any therapeutical and scientific purpose.

The electrical fever recorder is constructed in two different types.

In the first type, the rotating coil of the millivoltmeter is suspended from a strip of metal, the curve being recorded on a paper tape about 45 meters in length which is moved along by a clockwork at a speed of 20 millimeters per hour. The useful width of the tape is 120 millimeters. Below the paper tape there moves under the action of a clockwork an inking ribbon, over which oscillates a pointer carrying at its end a runner. The position of the pointer is marked by a dot each minute. The series of points thus produced forms a distinct curve. The clockwork should be wound up once a week, a new paper roll being inserted every three months.

The second type comprises a rotary coil located between points, so that the apparatus is insensitive to any moderate oscillations while not requiring accurate horizontal adjustment. The registering tape is wound together with a sheet of carbon paper round a drum. As in the former apparatus, a style marks time. The apparatus is designed either for a rotation of the drum (about 360 millimeters in periphery) in about 7 days or in 24 hours. The paper tape and carbon should be exchanged after each turn, which is a very easy matter. The dropping of the bow occurs, in accordance with the rotation speed of the drum, and takes place either every 12 or every 2 minutes. In order to allow for both speeds, the apparatus can be fitted with two drums, exchanged against each other by a simple manipulation. The useful width of the paper tape in this case is about 80 millimeters, i. e., somewhat less than in connection with the former type. This is why the one is generally used for accurate, scientific investigations and the latter for ordinary clinical apparatus.



Record obtained with fever recorder, showing effect of tuberculin ignition

Treasure Hunting.

BY GEORGE ETHELBERT WALSH

The United States Hydrographic Bureau and Coast Survey has charts of the Great Lakes and the Atlantic and Pacific coasts which are consulted eagerly by a large class of adventurers and hard, practical men of business and science, who are interested in the recovery of lost wealth through improved methods of deep-sea diving and wrecking. These charts are simple and unimpressive in appearance, and might easily be mistaken for ordinary coast charts with here and there dots to represent submerged reefs or rocks, but to the initiated they tell a whole history of romance and adventure, stories of shipwreck and disaster, tales of lost treasures and of strenuous efforts to recover them. The charts locate the position of sunken wrecks in water so deep that no divers or wreckers have yet succeeded in raising them or unloading from their hulls the wealth of treasure known to exist in them. Some of these wrecks carried down with them gold and silver bullion, which time and salt water cannot destroy, and others are laden with ores of great value, but not so generally prized by the treasure seeker. On the Great Lakes alone the exact positions of wrecks are charted which contain many millions of dollars in bullion and ore. There is no vague uncertainty about these treasures. They were known to exist in the holds of the ships, and no man has yet been able to recover them. The steamer "Pewabic," for instance, which went down in Lake Huron in a storm in 1865 carried with her half a million dollars worth of copper from the Lake Superior mines. For three decades expeditions sought to find the wreck, and finally it was located about six miles southeast of Thunder Bay. But the wreck was in such deep water that only a very small fraction of her cargo was ever recovered. Here is a submarine copper mine which might tempt the most adventurous soul to risk his life in gaining.

The chart of wrecks on the Great Lakes compiled by the Hydrographic Bureau and Coast Survey shows the relative depth of water and this simple record tells the whole story of why enterprising man has not been able to recover them. Divers seeking treasures in sunken vessels have learned that anything which lies much more than 100 feet deep is very difficult, if not absolutely impossible to recover. The pressure of the water beyond that depth becomes so great that diving suits are apt to collapse and crush the wearer. We know from a study of the charts that hundreds of ships loaded with treasures have sunk in water ranging from 100 to 250 feet in depth and if diving suits could be invented to withstand the enormous water pressure at the lowest depth and enable the diver to work easily, enormous fortunes could be quickly made.

The whole history of treasure hunting under the water has been marked by man's futile effort to fight against the pressure at great depths. One hundred feet below the surface of the sea, the pressure is about fifty pounds to the square inch. The ordinary diving suit of rubber is inflated by compressed air, which is regulated to the depth reached. Below one hundred feet the diving suit itself frequently collapses. There have been many fatal accidents in attempting to work below the 100-foot mark. For instance, when the steamer "Pewabic" was located in Lake Huron, a diver from Toledo, Ohio, went down to inspect it, and was hauled up dead. The steamer was in a depth of water approximating 200 feet. Two other divers in the next few years met the same fate. In 1893 Oliver [illegible],

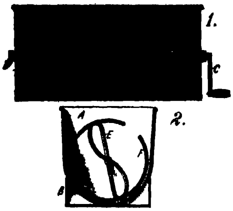
(Continued on page 227.)

AN ELECTRICAL DEVICE WHICH RECORDS A PATIENT'S TEMPERATURE FOR EVERY MINUTE OF THE DAY AND NIGHT.

Patent Department

DOUGH-MIXING APPARATUS.

Pictured in the accompanying engraving is a device adapted more particularly for kneading dough, but which is also applicable for mixing, stirring, or churning any material for household or culinary

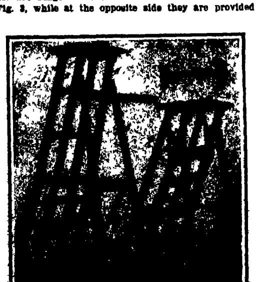


DOUGH-MIXING APPARATUS.

purposes. The machine comprises an approximately rectangular receptacle *A* formed, however, with a curved bottom, and an outer casing *B*, which acts as a support for the receptacle. The end walls of this mixing machine are provided with journal bearings, in one of which a crank handle *C* is supported. The other journal consists of a socket *D*, adapted to receive one end of a spirally curved stirrer blade *E*. The opposite end of the stirrer blade is formed with a threaded hub into which an extension of the crank handle axis is screwed. Secured to the stirrer blade at each end are a pair of outwardly projecting arms or curved fingers *F*, the object of which is to reach the material that is not properly stirred and mixed by the main stirrer blade. In use as the crank handle is turned, the fingers tend to feed the material toward the center, so that it is fully acted upon by the main blade. We are informed that in practice this type of stirrer kneads and mixes the dough thoroughly and evenly in a comparatively short time. By holding the stirrer blade and turning the crank in a reverse direction, the latter will be unscrewed from the hub so that both the crank and the stirrer blade may be removed from the receptacle. A patent on this mixing mechanism has been granted to Mr. Sanner E. Ray of McConnellsburg, Pa.

IMPROVED STEP LADDER.

In the SCIENTIFIC AMERICAN of November 14th, 1908, we published a description of a collapsible step ladder. An improvement upon this form of ladder has recently been patented, which is provided with an upper section that may be removed and replaced with a shorter section, thus reducing the height of the ladder. As shown in the accompanying engraving, the ladder consists of the lower side-rails *A*, connected by means of sleeves with the upper side-rails *B*. The ladder is collapsed by swinging one side against the other, but normally the rails are held apart by means of a diagonal brace, such as shown on the lower section of the ladder. The steps *C* of the ladder are hinged to one of the side-rails as shown in Fig. 3, while at the opposite side they are provided

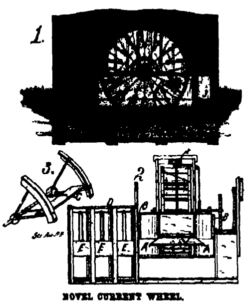


IMPROVED STEP LADDER.

with brackets *D*, in which are slots adapted to engage hinge pins secured in the side-rails *A*. This slot and pin connection provides the necessary play when the ladder is collapsed. The pins on which the steps are hinged lie at right angles to the rails *A*, and in order that the tread surface may be horizontal, the steps are made of a substantially wedge shape, as indicated in the illustrations. The top or platform *E* of the ladder is also hinged to the rails at the points *FF*, which lie on an axis at right angles to the rails *B*. To support the ladder in its normal inclined position, two legs *G* are provided. The legs are connected by the usual links *H* to the rails *A*, and at the upper ends they have extension pieces that are hinged to the rails *B*. When it is desired to shorten the ladder, these extension pieces with the upper rails *B* are withdrawn from their sockets. Then a top piece, such as indicated in Fig. 2, is applied to the ladder, the four short legs of this piece being inserted in the sleeves at the upper ends of the rails *A*. The legs *G* are now made fast to the rails *A* by means of pins *J*, which pass through them and also through the legs of the top piece. To prevent the legs *G* from spreading too far they are retained by means of brace bars *K*. The links *H* in this case are unnecessary and are folded upon themselves, as indicated in Fig. 2. Mr. William J. Blundell, Box 182, Brooklyn, N. Y., is the inventor of this improved step ladder.

NOVEL CURRENT WHEEL.

A number of advantages are claimed for the wheel illustrated herewith, namely, that it does not require the use of dams, it regulates itself to the rise and fall of the stream, uses only the surface current, is equipped with feathering blades, and is provided with means for preventing the parts from freezing fast in cold weather. The water wheel is supported on pontoons, as indicated at *A* in the illustration.

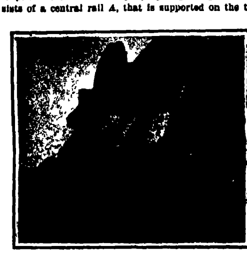


NOVEL CURRENT WHEEL.

The pontoons are connected by means of links or parallel arms *B* to a fixed framework supported on piles driven into the bed of the stream. Fig. 3 shows the construction of the blades used on the wheel. The spokes of the wheel are arranged in two parallel sets which are bifurcated at their outer ends. The blades *C* are hinged to rods connecting the parallel spokes and have free play in the bifurcated portions. This provides a very strong construction, and enables the blades to accommodate themselves to the current so that there is no lifting of the water as in an ordinary water wheel. It will be evident that as the water rises and falls, the wheel will rise and fall with it so that the blades will always extend to a uniform depth into the water. However when the water rises the surface current is apt to be very swift, and it is necessary to reduce the flow past the wheel. This is effected as follows. On the up-stream side of the structure a wing *D* (Fig. 2) is built out diagonally into the stream, so as to direct a large portion of the current between the pontoons and against the water wheel. In this wing are a number of flood gates *E* connected by means of ropes and pulleys to one of the pontoons *A* in such a way that as the water rises, the gates will open, permitting the water to flow through them, and thus cutting down the current that strikes the wheel. To protect the parts in cold weather, a casing is built over the wheel, at the top of which is a suction fan *F*. This is belted to the wheel as shown in Fig. 2. Through a duct *G* a current of warm air is conducted to the interior of the casing, and thence is sucked out of the top of the casing by means of the fan and delivered through the pipe *H* as indicated by the arrow. At the up- and down-stream sides of the casing, hoods *J* are placed, which come close to the surface of the water, and prevent the fan from drawing in cold air instead of the air through the duct *G*. The inventor of this improved water wheel is Mr. W. P. Spooner, Box 3, "The Manse," Carlevale, Saskatchewan, Canada.

CAR-RETAINING DEVICE FOR RAILWAY CURVES.

In order to insure the safety of cars when rounding curves, and to prevent the car wheel flanges from having undue frictional engagement with the rails, a safety mechanism has recently been invented, which is pictured in the accompanying engraving. It consists of a central rail *A*, that is supported on the ties



METHOD OF RETAINING CARS AT CURVES.

and is strongly braced by means of anchoring devices *B*, which are imbedded in the ground and terminate in plates *C*. The object of these plates is to prevent the anchoring devices from working upward. The illustration shows a portion of a car truck passing over the rail *A*. The axles of the truck are connected by means of auxiliary trusses *D*, below the main trusses, on which blocks *E* are supported. Designed to travel around these blocks *E* are endless chains *F* fitted with rollers. The rollers are pressed by the blocks *E* against the guide rail *A*. As the truck passes round a curve the rollers tend to keep it in place. Ordinarily the forward wheel on the outside of the curve tends to bear against the rail, owing to the fact that it is rigidly connected with its mate on the other side of the curve, and hence it cannot travel faster than the latter. The result is that the flange on the outer wheel is subjected to considerable wear. The centering device here shown, however, will prevent the flange of the outer wheel from being unduly pressed against the rails. The guide rail serves to prevent spreading of the rails, and keeps the cars from leaving the track. The inventor is Robert Belden, of Pulga, Cal.

MASSAGE APPARATUS.

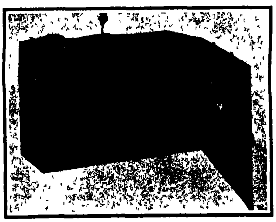
A patent has recently been granted upon a device for securing a vibrator to the hand for application in the operation of massage. The apparatus may be adjustable to adapt it for use by different persons and may be securely clamped to the hand, so as to impart to it the vibratory movement that is used in certain massage treatments. As shown more particularly in Fig. 2, which is a cross section of the device with the vibrator removed, it comprises a padded cushion *A* provided with two plates *B* and *C* which terminate in horns *E* and *F* that fit the palm of the hand. These horns may be covered with sleeves *K* of rubber if desired. The plate *C* is formed with two lugs, between which is mounted a screw *G* and the latter is provided with a knurled thumbpiece, whereby it may be

MASSAGE APPARATUS.

turned The plate B is fitted with a nut H that engages the screw, and as the screw is turned the plates are relatively adjusted to bring the horns closer or move them farther apart In this way the device may be clamped on the hand The cushion A, however, renders the device comfortable to the operator Projecting from the forward end of the device is a bracket I, as indicated in Fig 3, to which the vibrator mechanism is applied Fig 1 shows the preferred form of vibrator, which has a threaded stem that engages a socket in the bracket I A locknut J serves to make the vibrator fast This type of vibrator is sometimes equipped with a handle as indicated by dotted lines, so that it may be used without attaching it to the hand In such a case however various "applicators" are secured to the threaded stem to take the place of the operator's hand Fig 3 shows another form of vibrator, which is fastened to the bracket by means of screws The inventor of this massage apparatus is John Sabatino, Broadway near Spruce Morris Park New York

STREET INDICATOR FOR CARS.

The desirability of having the streets announced by means of a conspicuous sign in a street car has often been urged but hitherto efforts in this direction have met with little success Quite recently when a device of this type was about to be adopted on an important city line the objection was raised that it would obstruct and detract from advertisements placed in the cars This objection is overcome in the apparatus shown in the accompanying engravings, which not only announces the streets but also displays advertisements at the same time The inventor hopes that by making the device self paying as well as a convenience to the public, it will meet with better favor than street indicators heretofore devised The prominence of an advertisement placed where all eyes would be concentrated upon it should make this a most valuable advertising medium It is the inventor's idea to use a succession of advertisements so that the display could be changed at each street with the street number The sign display and street indicator is arranged to be hung at any suitable point in the car and immediately after passing a street the mechanism is actuated to announce the next street and display a fresh advertisement. This change is effected by means of contact plates which are secured to the cross wires supporting the trolley wire The contact plate engages a spoke of a wheel, causing the latter to make a quarter turn and momentarily close an electric circuit coming from the wire that supplies current to light the car This momentary impulse actuates a relay in the apparatus contained within the case of the indicator, and by means of a small electric motor the webs on which the street numbers and signs are printed are turned to the required degree Should one of the plates become detached from the cross wire the conductor can operate the indicator by means of a switch When the end of the line is reached the mechanism is reversed so that the streets will be announced consecutively in the reverse direction Should the car cross a different set of streets on the return trip, instead of running the web forward for the whole round and then rewinding at the starting point the web may be arranged to bear the streets of the return trip interspersed with the streets of the forward trip and a shutter may be employed to cover the street names of the first part of the trip, exposing only those of the return trip The inventor of this street indicator is Mr H Alwine, 214 South 11th Street, St Louis, Mo



STREET INDICATOR FOR CARS.

AN AUTOMATIC RAILWAY SAFETY SYSTEM.

It is a comparatively simple matter to develop an absolutely automatic railroad system in which the engineer will be entirely dispensed with and the trains will run under electrical control from some central controlling station The reason this has not been done so far, however is because no entirely automatic engine is as safe as one controlled by an engineer The railroads have long recognized the fact that what is needed is not a machine to take the place of the engineer, but one which will act as a check upon the engineer without taking the responsibility from his shoulders—a system that will perform the engineer's work in case of any lapse on his part and make a record of this lapse so that the responsibility for failure on the part of the engineer will be detected A system of this sort was recently installed for purposes of experiment over a short stretch of the Erie Railroad from Newark to South Paterson. The system is quite ingenious in the fact that it gives protection against broken rails as well as collision, and furthermore is provided with telephone connection which enables the engineer to communicate with station houses along the line when the train is brought to a stop for any reason and even while the train is running at full speed The advantages of this telephone system will be appreciated by passengers who can use it to communicate with their homes or to conduct business while en route and the train dispatcher is enabled to come into direct touch with the various units along the line which are under his charge In this system the track is divided into block sections, and the train as it enters each block electrically tests the block ahead to determine whether there is any obstruction on the rails or whether the rails are broken

The accompanying diagrams illustrate the equipment used On the locomotive there is a shunt wound dynamo driven by a small steam turbine which is supplied with steam from the boiler In series with the armature A of this dynamo is an incandescent lamp L a recording ammeter R, and an electro-magnet E which serves normally to hold the arm of valve V on the airbrake pipe of the train The fields F of the dynamo have their circuit completed through the metal frame of the locomotive. Should the field circuit be interrupted the magnet E would be deenergized, permitting the valve V to open, thus putting on the brakes and blowing the whistle W with air from the train line At the same time the lamp L

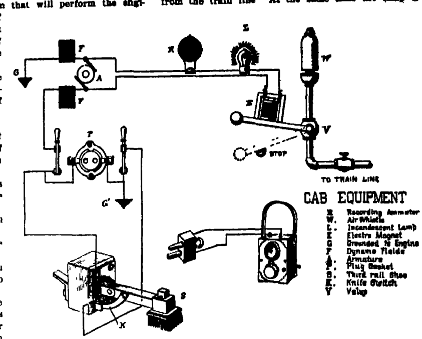


Fig 1—DIAGRAM OF ELECTRICAL APPARATUS AND CONNECTIONS ON THE CAB OF THE LOCOMOTIVE

would be extinguished and the ammeter would record the time when the interruption occurred The field circuit is grounded in the locomotive at G and G' Between the fields and the ground G' is a knife switch K mounted on a third rail shoe S At the side of each block extending for a distance say of fifty feet is a rail T (Fig 2) When the shoe S engages this rail it is lifted, opening the switch K and interrupting the circuit of the fields through the locomotive. However, the circuit of the fields would not open unless there should happen to be a broken rail or a train in the next block

Alongside the track are two lines, C and D, one of which is connected at intervals with the rails of the track while the other is connected with the third rail sections T These lines C and D run to a station house where the circuit is completed through a switch that may be opened by the engineer in charge of the house whenever he desires to stop the trains along the system under his control The line C contains a switch a for each block section, which is held in closed position against the tension of a spring by means of an electro-magnet R' The latter is connected in series with the rails of the track and is energized by a battery B at the opposite end of the block system In case of a breakage in one of the rails, or should a switch be thrown open, the magnet R' would be de-energized, permitting the switch a to open and thereby break the field circuit of the dynamo on the approaching train with the consequent setting of the brakes as described above The same result would follow if the circuit through the magnet R should be short-circuited by a train on the block At P (Fig 1) is a plug socket adapted to receive the telephone plug connection. The telephone circuit is completed past the switches a through a coil R^2 This resistance permits the passage of the alternating current of the magneto and telephone, but prevents the passage of the direct current to the dynamo so that telephonic communication is not interrupted by the block system.

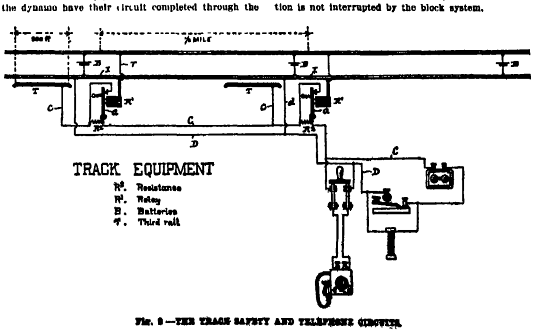


Fig. 2—THE TRACK SAFETY AND TELEPHONE CIRCUITS.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

BUTTON-FASTENER.—H. G. C. Hönning, New York, N Y The fastener quickly fastens a button in place on a garment by the use of a pin engaging and holding the button and adapted to be passed through the cloth of the garment, the pin engaging a retaining device on the back of the garment and preferably formed of a plate having a head and neck for engagement by the U-shaped end of the pin to fasten the pin and plate together.

Electrical Devices.

SWITCH-PLUG.—P. C. Ewing, Little Rock, Ark. In this improved construction, the inventor permanently connects the cord to the plug, so that the cord extends from the plug at approximately an angle of ninety degrees. The plug remains in a horizontal position when in use and out of use, and the movement of the plug from one position to the other, does not cause binding of the cord at its point of connection with the plug.

Of Interest to Farmers.

GRADER.—J W Beasley, Modesto, Cal By the use of this mechanism the earth is plowed and delivered to an elevator and distributer, plowed dirt is delivered at each side of the machine alternately so that it may be distributed or received in a conveyor for removal, the delivery being manually controlled, the receiving drum guides the delivery belts and forms a driving member therefor and delivers the dirt from the interior of the drum upon the belts and the manually-operated controls command the operating mechanism.

Of General Interest.

WALL-MOLD.—E. W Collins, Fort Dodge, Iowa. This invention pertains to cement or concrete walls, and its object is to provide a new and improved wall mold for use in building a monolithic concrete wall, with or without air spaces and with a facing of a different, finer material to enhance the appearance of the wall.

MATCH CASE.—B Epstein New York, N Y This invention relates to match cases, particularly to such as are adapted to be carried in the pocket The device is especially to be used as a case for matches which are permanently attached to a card-board sheet or holder, and which are adapted to be torn off one by one when used. These matches are attached at their lower edges to the lower edge of a flap, and this projects in a direction in which the heads of the matches lie

WALL.—M B Ensminger and J W Shaffer Fostoria, Ohio. In the present patent the invention has reference to improvements in walls, and it has for its object the provision of a construction whereby there is an air-space between the blocks forming the wall and the plaster-boards or laths, without its being necessary to veneer the blocks.

FIRE-ESCAPE LADDER.—W A Farmer Arcade N Y This collapsible ladder may be conveniently stored adjacent to a window, and is adapted to be readily adjusted out of the window in case of a fire It is strong, of light weight easily manipulated, and will automatically space itself from the side of the building so as to leave room on the rungs for the hands and feet of the user

VAGINAL SYRINGE.—O Katzenberger, Chicago Ill This invention is more especially designed for use in spraying medicinal powders onto the diseased parts and arranged to permit conveniently charging the powder container of the syringe with powder, to insure a proper spraying and spreading of the powder and to provide an escape for the air pressure from the parts.

ORE SEPARATOR.—G W Kunkel, King City Mo When the toothed cam wheels rotate the feed end of the screen frame will have imparted thereto a series of rapid vertical impulses, while the frame will be vibrated rapidly in a horizontal plane and in a longitudinal direction by one of the cam wheels, the wheels moving the frame one direction and springs in the opposite As the ore is fed onto the feed end of the screen a jumping motion is imparted thereto, tending to move coarser particles above the finer, permitting them to pass through the screen, while the ore travels longitudinally of the screen by action of the cam wheels.

BEER TAPPER.—W W Frisholm Leadville, Col The invention relates to that type of tapper in which the valve is fitted in the bushing of the bung hole and the patentee provides a novel arrangement of valve casing as securing devices and passages with a view of facilitating the operation and the action of the tapper in controlling the fluid to be drawn

DRINK-SHAKER.—J Heinrichs, New York, N Y The invention relates to drink mixers, and its object is to provide a shaker, more especially designed for use in making cocktails, milk punches and like drinks, and arranged to allow convenient mixing and cooling of the ingredients and straining and pouring of the drink into a glass.

ORE-MILL.—T C Hinton, Shawnee, Okla. In this case the invention is an improved mill for reducing ores containing precious metals, particularly quartz ores of both hard and soft varieties. It combines the functions of a stamp mill and a grinder, in that it is adapted to hammer the ore so as to break it into small pieces and then grind and crush it into smaller particles.

HOLDER AND MEASURING DEVICE FOR GRANULAR MATERIAL.—A. A. Hautt, Chicago, Ill In the present patent the purpose of the inventor is to provide a receptacle for granular material such as tea, and combine therewith novel, simple, and convenient means for measuring and discharging a quantity of the contents of the receptacle into a vessel for use

ADJUSTABLE CURVE-RULER.—C O Harper, Omaha, Neb. The invention consists of an abscissa ruler or straight edge, a spring ruler, and ordinate rulers adjustable laterally and arranged at the opposite end portions and at an intermediate point of the spring ruler, and two outer ordinate rulers having pivotal portions connecting them to and adjustable along the length of the spring ruler

PAPER BAG HOLDER.—J W Dunnigan Altoona Pa. The object of the invention is to provide a cheap and serviceable rotating paper bag holder which will furnish a maximum of separate holders in a minimum of space and wherein each size of bag will be in a separate bunch and may be easily got at and removed. It is the only rotating bag holder ever devised and being triangular in shape, gives three sides that revolve in the space of one.

VAPOR EXTRACTOR FOR USE IN TREATING WHISKY BARRELS.—B H Hubbert, Highlandtown Md The invention is a vapor extractor for use in treating whisky barrels, and in operation, steam or other medium may be introduced through the inlet pipe to operate upon the interior of the barrel, and then be discharged through the ports and the body and outlet in the operation of the apparatus.

WATER-GLASS-GAGE CUTTER.—F Blodgett, Butte, Mont This instrument cuts glass tubing from the inside thereof, to form water gage columns, the cutter may be set to sever an article to the size desired It is adapted to cut the inside surface of a tube, having means for exerting an outward pressure upon the point of operation and the parts of the implement are held and returned to their normal position by automatic means.

Hardware and Tools.

LAWN SPRINKLER.—G H Choate Hailey Idaho. This invention provides a sprinkler which may be placed beside a foot-path for a house to irrigate the lawn without wetting the walk or house provides one which may be secured in position by the operator without necessitating the suspension of the flow, and one of a structure diminutive and easily handled

STEP LADDER.—W J Blundell, New York N Y This invention relates more particularly to that type of ladder disclosed in a prior patent granted to Mr Blundell One object of the present invention is to so construct the side rails and legs of the ladder that each may be separated into two sections, and one of the sections replaced by a shorter section to produce a step-ladder of shorter length.

CLASP.—A O Boyland, Aurora, Neb In the construction of this clasp the applicant provides a pivoted jaw having a spring tongue at its pivot end for holding the jaw closed and at the opposite end a cam device is provided which co-acts to maintain the tongue in its holding position

BOLT AND NUT LOCK.—C H Ferguson, Jersey City, N J More particularly the invention refers to a nut lock in which there is employed a plate or washer having a yoke which may be bent up to partially inclose the nut, or at least engage with a plurality of sides of the latter The plate is so formed that it is automatically held against rotation and serves not only to lock the nut in place but may also lock either the bolt or a second nut, or all three.

Heating and Lighting.

SAFETY PLUG.—E. H Bastion Fairbury Ill The object here is to provide a plug, for convenient attachment to the crown sheet fire sheet, or other part of a boiler, to indicate danger in case of low water level, and arranged to prevent the fusible material from being dislodged or blown out of the plug body by pressure in the boiler to insure an even heating of the fusible metal core, to prevent the plug body from being clogged up by sediment, and to provide a ready flow of molten metal out of the body of the plug and permit free escape of pressure to relieve the boiler of undue strain.

TANK HEATER.—W Tinkle, Anamoose, N D The aim of this inventor is to provide a means for heating the water in a tank or reservoir, the heater to be partially submerged in the water and having means for supplying fuel, and for permitting the removal of ashes, and the entrance of sufficient air to properly consume the fuel.

Household Utilities.

CRADLE.—L. Vargas, New York, N Y This improvement is in motor-actuated cradles, and has in view a cradle supported to oscillate about an approximately central vertical axis, the cradle in its preferred construction having an annular track on the under side which is arranged to be alternately engaged at opposite sides by wheels or segmental gears driven by the motor

GARBAGE-CAN.—W B. Osborn, Clarksburg, W Va. The main purpose of the invention is to provide a garbage can which has a hinged cover pivoted in such a manner that it may be raised by foot pressure, thereby permitting the use of both hands in transmitting the garbage into or removing the garbage from the receptacle.

Machines and Mechanical Devices.

BOTTLE-WASHER.—R J Phelps, Callicoon N Y This invention refers to bottle washers and fillers, and the object of the invention is to provide an apparatus of simple construction, in which a number of bottles can be rapidly washed and refilled and when the bottles in the frame are filled it descends and the bottles can be removed for corking.

BUILDING BLOCK MOLD.—C J T Combes, Waldwick, N J This mold is adapted to make blocks of different sizes The invention contemplates an arrangement in which the sides or walls of the mold may be moved outwardly so as to enlarge the mold, and the mechanism includes means for moving some of the walls in unison so that the cores for the block are advanced automatically into position

PIANO-SWELL.—Sarah W Clark, New York, N Y It has been found that the movement of the lid by mechanism concealed from the audience often operated to distract its attention from the music and constituted a disturbing element In the present patent the inventor avoids this objection by providing means within the casing of the instrument and entirely concealed from the audience, for controlling the volume of sound Her new mechanism is separate and distinct from the lid of the instrument

LIQUID-EJECTING APPARATUS.—H K Smith, Union S C In the present patent the invention is an improvement in apparatus for dispensing liquids adapted for use in ejecting soda water syrups and mineral waters and other liquids. The fountain construction in this apparatus forms the subject of a separate application for patent which Mr Smith is about to file

LIQUID-DISPENSING APPARATUS.—H K. Smith Union, S C In this case the invention is an improvement in apparatus for dispensing liquids adapted for use in dispensing soda water syrups and mineral waters and other liquids. The present patent is a divisional application of Mr Smith's prior application filed in the United States Patent Office

CABLE-CLAMP.—C A Butler Bartlesville Okla In the present patent the object of the invention is the provision of a new and improved cable clamp, more especially designed for use on well-drilling tools and other devices, and arranged to securely clamp the cable and to positively hold the same against slipping.

METER BOX.—L. P Andrews, Sedalia Mo One object of this inventor is to provide a box, which serves as a protection for the meter incased therein which can be easily opened to permit the meter to be read, the closure of which can be locked securely in place to prevent accidental or unauthorized opening thereof, and which is substantially water tight.

Prime Movers and Their Accessories.

CARBURETER.—P J Danby New York N Y This invention has reference to carbureters such as used in connection with gas engines. The object of the improvement is to produce a carbureter having an improved construction which operates to draw the air in a concentrated current directly across the fuel opening from the admission valve

Railways and Their Accessories.

SPARK ARRESTER AND DRAFT REGULATOR FOR LOCOMOTIVES.—R J Habib Tanta, Egypt The aim in this patent is to provide an attachment for distributing products of combustion more evenly, or causing them to pass through the lower flues as well as the upper and also for arresting the sparks, which under other circumstances, would reach the smokestack and be discharged therefrom It effects considerable economy in coal consumption.

RAILWAY CROSSING.—A H Havard Urbana, Ill In this instance the invention has reference to railroad crossings and it has for an object the provision of a crossing for railroads, adapted to minimize the amount of noise occasioned when a train is passing over the crossing, and the said crossing being safe and efficient.

Pertaining to Vehicles.

DUST PROOF SELF-OILER FOR AXLES.—J J McGuire, New York, N Y This invention relates to wheels such as carried by carts and wagons. The object of the improvement is the production of a wheel having an axle box which will be self-oiling and substantially dust proof The absorbent material placed in the dust chamber is preferably formed of lamp wick or similar woven material

Note.—Copies of any of these patents will be furnished by Munn & Co for ten cents each Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc This will facilitate answering your questions. Be sure and give full name and address on every sheet

Full hints to correspondents were printed at the head of this column in the issue of March 13th, 1909, or will be sent by mail on request.

(12206) E. J B asks A said that a bullet shot in the air (the carrying power of the rifle being one mile), after reaching its limit will return to the earth just the same as if you were a mile in the air and shot a bullet from the same rifle toward the earth B says that the bullet shot from same rifle one mile toward the earth will reach the earth sooner than the bullet dropped from a mile in the air A If a bullet is shot from a rifle so that it rises a mile into the air it will be for an instant at rest at a point a mile above the earth, and neither rising nor falling It will immediately begin to fall as if from rest, and fall a mile to the earth It will strike the earth with the velocity acquired by a fall of one mile through the air This will not be the same as free fall since the air will retard its fall somewhat If a rifle at a height of one mile above the earth discharges a bullet vertically toward the earth, the bullet will have two forces acting upon it the force of the powder and the force of gravity, both urging it downward and its velocity will be that given by the sum of the two forces It will reach the earth in much less time than would be required for a falling ball A is wrong and B is right

(12207) W I S asks Please advise when the twentieth century began whether on the first day of January 1900 or January 1 1901 A The twentieth century began at midnight of the morning of January 1st, 1901 The year 1900 was the hundredth year of the nineteenth century Begin and count from one and you will find that 100 is the last number of the first hundred, so 1900 is the last number of the nineteen hundredth of numbers or centuries

(12208) G P asks Will you kindly inform me as to the construction of the siren whistles as used on the United States navy boats? Some tell me they consist of a disk having slits cut between the center and circumference which is caused to whirl by steam pressure others say not While not a yearly subscriber I get your valuable paper from the newsstand and would very much appreciate a reply to this inquiry A Sirens are made very much as you describe although round holes are more frequent in the larger sizes than slits. There are two plates the lower stationary and the upper revolving In the lower the holes are vertical and in the upper they are inclined all at the same angle but the lower end of the holes in the upper plate register with those in the lower when still When steam is turned on the upper plate is revolved exactly as a windmill is blown round and the faster it turns the more frequently the holes register cutting off and passing the steam alternately This causes vibrations of shorter and shorter period to be applied to the bell of the whistle, giving a higher and higher note, till the steam is cut off when the note descends in the same way

(12209) T A G asks Can a circle be squared? If so how can it be done? I have read in papers about people working on it for years and could not do it Is it only a joke or are those people in my class and don't know how to count? What I mean is, to square a circle of any size down to the very finest square the fingers can make A A square of exactly the same area as that of a given circle cannot be constructed In other words one side of a square whose area shall be equal to that of a given circle cannot be found by the use of drawing instruments A number of approximate solutions have been made The area of a circle is found by multiplying the circumference by half the radius The circumference is found by multiplying the diameter by the number 3.14159265358 etc a number which never comes to an end and which has been computed to a very large number of decimal places Now since the circumference cannot be exactly found the area cannot be exactly found and the side of the equivalent square cannot be exactly found

(12210) C W asks I would like very much to have you explain how it is possible for an ice boat to go faster than the wind I am quite sure it does this though I have not the instruments to prove it If it does it appears to be contrary to the laws of conservation of energy A An ice boat sailing before the wind does not go swifter than the wind That is impossible even when we take account of the small friction of ice It will retard the boat somewhat But when the boat sails near the wind the line followed by the boat is longer than the distance the wind travels while pushing the boat a distance equal to its length and so the boat moves farther than the wind moves in the same time You will find the point discussed in our Supplement, No. 214

NEW BOOKS, ETC.

The Gas Turbine. Progress in the Design and Construction of Turbines Operated by Gases of Combustion By Henry Harrison Suplee, B Sc Philadelphia J B Lippincott Company Pp 262 Amply illustrated

In view of the rapid advancement in the development of the gas turbine the literature upon this important subject must be regarded as quite inadequate Hence the value of the present work by Mr Suplee whose name is synonymous with very thorough accurate and illuminative work in literature of this character Although the gas turbine was one of the earlier forms of the combustion motor the high temperature and high rotative speed involved have rendered the mechanical problems connected with centrifugal action so difficult of solution that progress has been slow compared with that in the production of the steam turbine Nevertheless some very effective experimental work to say nothing of theoretical investigation has been done during the past few years by English French German and American scientists Unfortunately most of the information regarding this work is in a form unavailable for the practical engineer and investigator The theoretical discussions are to be found chiefly in the transactions of professional societies and the practical work has been done behind closed doors In the present work Mr Suplee has gathered under one cover the most important papers which have appeared upon the subject of the gas turbine together with some account of the work done in America To this has been added such information upon actual experimental machines as could be secured The various papers are preceded by an historical chapter of great interest which throws much light upon the early history of the gas turbine, which the reader will be surprised to learn dates back in its primitive form to the medieval "smoke jack" which has been attributed to Leonardo da Vinci Of equal historical interest is the information that Barber in a British patent of 1791 completely anticipated nearly all the most recent developments in gas turbine practice The illustrations, chiefly line cuts are numerous, and the tables and diagrams afford just that exact information of which the inventor and experimentalist is in need We commend this work as a most valuable addition to the too scanty literature upon this subject

Paints for Steel Structures By Houston Lowe New York John Wiley & Sons, 1910 16mo, 109 pp Price, $1

About thirty years ago practice in the making of linseed oil varnishes japans and colors first brought the writer into daily contact with questions regarding the manipulation of paint its properties and the results of the various operations to which it was subjected Painters, engineers architects, builders and constructors have since been continuously asking questions whose answers involved thought and experiment At one time paint making was an art, then it became a trick now it is a science This little handbook is written by a paint maker and is the direct result of study recently given to the manufacture and proportion of structural steel and the use of paint in its preservation During the ten years which have passed since the first edition of this book the author has continued his observations experiments and tests on a more elaborate scale than ever before and with careful attention to every point needing consideration The book appears to be a most valuable one

American Annual of Photography New York George Murphy Incorporated publisher 1910 8vo, 328 pp Price, 75 cents in paper $1 25 in cloth, postage 15 and 20 cents extra

This volume which is No 24 is edited by John A Tennant It is filled as usual with valuable photographic hints and is beautifully illustrated It will be warmly received by all amateurs.

Vehicles of the Air By Victor Lougheed Chicago Reilly & Britton, 1910 8vo, pp 479 270 illustrations and diagrams Price $2 75 postpaid

This book fully meets the demand for a popular semi-technical treatise on mechanical flight Its author is above all else a thoroughly practical man and one who has had wide experience with automobiles and their motors. As a result of this the chapters of his book on power plants and transmission mechanism are very illuminating The various kinds of lighter than air and heavier than air flying craft are illustrated and described in detail and the whys and wherefores of different forms of construction are made known Many details of aeroplane construction are given in a clear and concise manner and illustrated by diagrams Fifteen leading aeroplanes are described in detail most of them with the aid of scale drawings and handsome large half tone engravings The author discusses the work of the pioneers of aerial flight and so thoroughly does he go into some of the burning questions of the hour such as wing warping and the like that he publishes the complete patent specifications of Lilienthal Chanute Montgomery Wright, and Montgomery The last named gentleman's paper on "Principles in Wing Formation and the Phenomenon of Soaring" which was prepared for the Aeronautical Congress in 1907 at the outcome of a [illegible] in the Scientific American Supplement [illegible], is also printed in full and will be found extremely interesting. A very complete list of flights made up to November, 1909, is one of the many excellent features of this work.

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 1, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

THE ROCK-HEWN CITY OF PETRA.

(Concluded from page 221.)

peoples of the land. These "high places" were the subjects of many warnings to the children of Israel. There are other high places in the vicinity of Petra.

Still another interesting ruin is of the so-called Ed-Deir (the convent), and is reached by an hour's hard climbing along ravines and up rock-hewn staircases, to the northwest of Kasr Farioun Passing the striking Tomb of the Lions, we reach at last the high plateau on which stands Ed-Deir It is nearly 150 feet long and almost as high, being similar to the Khazneh, having its double rows of six columns each, but widened by corner-pilasters on both sides and on both stories On this plateau there are several places of sacrifice and a fine view of Mount Hor to the southwest

The early history of Petra is hidden in the mists of remote antiquity It was probably the capital of Edom Its first mention is in sacred history in II Kings 14 7, which records its conquest by Amaziah in the ninth century B C From Is, 16 1, we learn that it was then, about 700 B C, held by Moab It is evidently referred to in several prophetic denunciations whose fulfilment has been most literal About 300 B C it had come into possession of the warlike Nabataeans descendants of Nebaioth the eldest son of Ishmael, who made it their capital and it was known to the Greeks as Petra Strabo the Greek traveler and historian describes it at the end of the last century B C, as also did Pliny the Roman writer in the first century of our era In A D 60 Aretas IV King of Petra had extended his conquests to Damascus and is referred to by St Paul in II Cor 11 32 In 105 A D, in the reign of Trajan, it passed under Roman rule Ecclesiastical historians in about the fourth century mention it as a Christian metropolis It continued populous and prosperous as a trade depot until about the beginning of the fourth century when the caravan routes from the north which had for so many centuries led past its arched portal to the Red Sea were diverted to the Persian Gulf After this it rapidly declined and it is not heard of again until about A D 536 Even its very existence and site were forgotten until it was visited and identified by Seetzen in 1807, and explored and described by Burckhardt in 1812 the latter gaining access to it as he also did to Mecca, in the disguise of a Moslem pilgrim

Treasure Hunting.

(Continued from page 223)

a noted Lake diver, devised a diving suit strengthened with metal rings to support the rubber against the enormous water pressure In this suit Pelky made a successful exploration of the ship but on his second descent his suit collapsed and he was hauled up dead

Even this fatal accident did not deter wreckers from planning further attempts on the immense cargo of copper at the bottom of the lake A famous diver of Duluth, Minn, M F Chalk by name, was invited to go down, and to tempt him to make the venture $2,500 were offered him before he went down and a written promise that he would get one-half the net returns from the wreck In addition to this his life was to be insured for $20 000 for the benefit of his family But after making an examination of the location and the depth of the water, Chalk refused this flattering offer.

Many accounts of great depths to which divers have descended to inspect wrecks and help to recover treasures must be accepted with a little grain of salt. For instance, John Haggerty, who went down to inspect the steamship "Oregon," wrecked off Fire Island, was generally reported to have reached a depth of 185 feet. But to disprove this the hydrographic charts show that the depth of water where the steamer sunk was only 1?? feet. Other remarkable diving feats

(Continued on page 232.)

(*Continued from page 237*)

must also be accepted with a slight allowance for exaggeration

In recent years deep-water salvage of treasure ships has excited the cupidity of divers adventurers, and business men There is altogether too much wealth lost under the water to suit us. Here is what an expert diver and wrecker has to say on the subject

'Within fifty miles of Sandy Hook there is wealth enough sunk in the ocean sand to stock the United States Treasury All the private treasure ever buried in the earth would be a trifle by the side of it The bottoms of both the Atlantic and Pacific Oceans are vast treasure beds. The man who can devise a means of traversing the ocean bottom might rival Rockefeller A vast amount of treasure is as accurately located as the banks of Wall Street Any experienced diver can take you to a chart and lay his fingers on any one of twenty spots and say 'Go to longitude so-and-so in a latitude defin able within fifty feet, dive deep and bring up a fortune Only you can t dive deep enough A great deal of this treasure is the deposit of recent years Still more went down before the days of ocean liners At one time specie was transported in men-of-war Gold dust and diamonds were shipped from mines on rickety schooners for want of better craft '

In twenty years there were nearly five thousand wrecks on the Great Lakes. Of these over one-fifth or approximately one thousand, were total losses The total cargo losses on these wrecks are estimated at $12,000 000 and much of it is in indestructible form of property These tragedies on the lakes go back to 1680, when La Salle's ship, the 'Griffon,' disappeared in Lake Huron with $12,000 in coin Besides the 'Pewabic" which went down with half a million dollars' worth of copper, the steamers 'R. G Coburn" and City of Detroit' were lost off Saginaw Bay in 1871 and 1873, with cargoes of copper aboard worth at least $50 000 each None of this treasure has been recovered The steamer "William Home," which sunk in 1895 off Swishwah Point, Lake Michigan, carried to the bottom $20,000 worth of steel billets, and the steamer "Clarion ' lost in 1851 between Cleveland and Detroit, carried a deck load of new locomotives to the bottom. Iron and coal cargoes have been distributed freely over the bottom of the Great Lakes and some day the miners of these ores equipped with improved diving dress, may recover good-sized fortunes from the bottom of the lakes.

Lake Huron is considered the greatest scene of treasure hunting, and it is commonly spoken of in the lumber camps as 'The Lake of Sunken Treasures ' The reason for this is that back in the early lumbering days large sums of money were shipped to the numerous lumber camps in small vessels, and literally dozens of these were lost. All of this money lies somewhere at the bottom of the lake for the treasure hunter to find

Among the many important wrecks of treasure ships which are partially or exactly located on the charts of the government, mention should be made of the Pacific Mail steamship 'Golden Gate,' sunk near Manzanilla, Mexico with $600,000 in gold coin and bullion and the Klondike steamer "Islander," sunk off Douglas Island, Alaska with $375 000 in gold dust The greatest prize of all sunken treasures—if all is true which history records—is the Spanish galleon which went down five miles off Lizard Point on the Cornish coast in 1784 with $85,000 000 in gold The Spanish flagship "San Pedro was another rich prize, carrying to the bottom of Cumana Bay, Venezuela, $2 000 000 and the ship "Central American" went down off Havana with a similar amount in gold The steamship "Lexington" which went down in Long Island Sound was reported to have contained $300 000 in specie

The record of these sunken treasure

(*Concluded on page 239*)

Car draft appliance, railway, W. R. Matthews 950,490
Car draft gear, railway, W R. Matthews, 950,[illegible] 950,489
Car handling mechanism, A. J. Lafayette, Jr. 950,[illegible]
Car, passenger, W B. Adams 951,0[illegible]
Car roof, J Mackay [illegible]
Car roof, P H. Murphy [illegible]
Car roof, W P Murphy 951,[illegible]
Car seat, H. G Budd 950,746
Car wheel, L. G Woods 950,900 950,[illegible]
Cars, safety device for railway, J F Miller 950,736
Carbohydrates into hydrocarbons, converting, A Heinemann 951,073
Carboy necks, protective device for L. Furbush 950,730
Carbureter, T J Grott 951,[illegible]
Carbureting apparatus, M W Pill [illegible]
Carpet fastener, F H West [illegible]
Carriage and sled, combined, W W Vicks 950,[illegible]
Carriage iron, L. Kuchenbecker 951,0[illegible]
Cast iron pipe, C. R. Schmidt 950,575
Caster for operating tables, A Taubert 950,845
Casting apparatus, J W Latcher 950,667
Casting metal bars, wires and pipes, F W Wimmer 950,[illegible]
Catch, safety, T Mountford [illegible]
Ceramic wares, producing R. S. Powers 950,[illegible]
Chair A. Wanner, Jr 950,974
Chair, A. Wanner Jr 951,0[illegible]
Chalk holder, D W Shepherd 950,[illegible]
Churn, A Burch 950,[illegible]
Cigar tip cutter, W R. Dalrymple 950,516
Cigar tip cutter, L. M. Garrigus 950,[illegible]
Clamp, R. H. Gensburg 951,0[illegible]
Clarinet, F Bamos 950,[illegible]
Clasp, T Fabritius 950,784
Cleaning device vacuum, Goehst & Dunlap 950,707
Clip tie or gland puller, L. Hammond 950,649
Clothes drier, F T Johnson 950,923 950,924
Clothes line support J C Michaud 950,[illegible]
Clutch mechanism, Talbot & Brott 951,064
Cock ball F Mohl 950,946
Cock boiler blow off J F Sengler 950,[illegible]
Coin controlled lock W H Kluge 950,[illegible]
Coke oven door, W O Abbott 950,[illegible]
Comb, I R. L. Shearer 950,968
Composing stick Colthar & Pfeifer 950,680
Concrete structures, anchoring device for use in connection with, A P Lohmann 950,771
Condensing plants, air indicator for steam R. L. Weighton 950,976
Conduit or subway, Burr & Lockwood 950,619
Confection explosive shell, L. Braquier 950,[illegible]
Container, G R. Cleveland 950,475
Conveyers, feeder or receiving pan for, G Holmes 950,621
Cooker fireless, S. D Baker 950,[illegible]
Cooking utensil M. F Dolan 950,844
Cooking utensil lid and cover Milholland & Sweltzer 950,[illegible]
Cooking vessel B. F Ferguson 951,[illegible]
Cord clamp, F C Perrott 950,[illegible]
Core collapsible, B F Smith 950 [illegible]
Cork and cork puller, combined, R. Kearney 950 751
Corn crib, W B Engel 950,[illegible]
Corner bead fastening H Keglin 950,[illegible]
Cotton chopper O. G Hanes 950 481
Cotton chopper, M J Bunnell 950 [illegible]
Cotton chopper O S. Snow 950 [illegible]
Cotton picker, F M Dunnelly 951,[illegible]
Counter C. H Veeder 950,846
Coupling See hay loader coupling.
Coupling device, interchange R. R. Adreon 950,812
Crate hog breeding, H G Carr 950 [illegible]
Cream dipper, A. Wilcox 950,[illegible]
Cream separator, G T Soderstrom 950,605
Cross tie and rail fastener J L. Austin 950 984
Culvert corrugated sheet metal W M. Lane 950 [illegible]
Curling iron heater electric, C P Harmon 950,620
Current distributer and timer J M Smith 950,706
Current motor F A Price 950 [illegible]
Curtain bracket R. A Chamberlin 950 611
Curtain fixture C L. Hopkins 950,[illegible]
Cutting board attachment L. B Nicholson 951,023
Dental aseptic tray and stand therefor C F Booth 950,[illegible]
Dental bracket engine J F Hammond 950,768
Deodorizing and drying night soil and the like, means for M T Welcome 950 977
Deposit box safety Loreau & Callaghan 950 935
Desk, writing and reading, H Slingenstren 951 053
Dish soap A F Riegger 950,[illegible]
Dispensing and printing machine C A Alden 950,789
Display apparatus, J Vormbaum 950,498
Display cabinet E Moore 950 673
Display cabinet for laces, etc, O A & F W Hunger 951,073
Display matter support T Harrington 950 912
Display rack I W Kennett 951 081
Display rack for holding hats, W B Sandifur 950 981
Door bolt double J & A Ledoux 950,851
Door check, J Ewart 950 [illegible]
Door stop, T A Smith 950 707
Door supporting device, M Cumry 950,717
Dough severing device, J Newfield 950 727
Draft-equalizer, F Clark 950,840
Draft gear H C Buhoup 950,472
Draft gear O A Lindstrom 950,570
Draft regulator H R. Hemphill 950,918
Draw bar, J H Troup 950 [illegible]
Draw bar splice J A Anderson 950,[illegible]
Drawer locking device J Bodenstein 950 818
Drier See clothes drier
Drier W Robertson 950 [illegible]
Drills, forming twist A Ward 950 645
Drills, means for forming twist, A Ward 950,646
Driving mechanism, H L. Johnston 950,[illegible]
Dumb waiter and elevator H A Smith 950,[illegible]
Dumping apparatus for pipe machinery and the like automatic W B. Sanford 950,729
Dye, orange to brown, Blank & Rodionow 951,045
Dye, reddish brown cotton, Blank & Rodionow 951 049
Dye, yellow to brown, Blank & Rodionow 951,046, 951 047
Dynamometer E. A. Johnston 950,511
Electric battery W Morrison 950,861
Electric device single phase gas or vapor, P H Thomas 951 065
Electric furnace, J Thomson 950,877
Electric furnace J Thomson 950 879-950,[illegible]
Electric furnace F A J Fitz Gerald 950,804
Electric furnace Thomson & Fitz Gerald 951,068
Electric heater M. McGerry 950,[illegible]
Electrical connection plug A N Uoda 950,[illegible]
Electrical recorder, H. F Northrup 950,[illegible]
Electrical testing apparatus, H J Blakeslee 950 714
Elevator, C D Seeberger 950,[illegible]
Embossing attachment, F H Hoberg 950,[illegible]
Engine P O Poulson 950,[illegible]
Engine and tool operating mechanism, combined J Weiner 950 750
Engine muffler gas, J Kellington 951,080
Engine starter, gasolene, E. A. Gardner 950,[illegible]
Engines, automatic steering device for traction, J R. Rogers 950,604
Engines, automatic switch for reversing gas, J M. Hart 950,704
Ether and alcohol, apparatus for recovering, C. Crepelle-Fontaine 951,007
Excavator, drainage M G Bunnell 950,[illegible]
Faucet attachment G R. N Dow 950,[illegible]
Faucet, measuring and registering, W J McMillan 950,[illegible]
Feed water regulator F H. Pleuss [illegible]
Feeder, automatic boiler C. J Lindberg [illegible]
Fence post mold P Single [illegible]
Fiber cleaner, H Pettit [illegible]
Fire extinguisher A Ammentorp [illegible]
Firearm, S. Paulson [illegible]
Firearm, automatic S. Paulson [illegible]
Fireproof jewel-case L. Waldeck [illegible]
Fishing rod reel clamp, B. O Bush [illegible]
Floor jack, J W Marsh [illegible]
Fluid pressure motor and pump, T. & W. Moss [illegible]
Fly catcher, B. Douglas [illegible]
Forging machine, C. M Conduit [illegible]
Fork. See hay fork.
Fork, Beals & Stephens [illegible]

(Concluded from page 228.)

ships along our two coasts and Great Lakes could be extended indefinitely. Some of the treasure has been recovered, such as the boxes of gold lost in the Spanish steamship Mercedes, sunk near the Canary Islands, but in most cases very little if any of the money has ever been brought up by divers.

There have been strenuous efforts made to salvage these known wrecks, and inventors have been busy for half a century devising means of getting at the wealth lost under the water. The aluminium diving suit that resembles ancient armor with articulated joints at the shoulders, knees and hips is one of the new inventions designed to make deep-sea diving practical. With this armored suit divers expect to reach a depth of 250 feet without experiencing any great difficulty in resisting the pressure. The pressure of water on the joints of this armored diving dress was so great that ball bearings of harder material than aluminium were found necessary. The aluminium suit protects the diver from the water pressure, and at great depths the armor is so light in weight that a man can walk around easily with it on. In addition to the articulated armor suit the diver is provided with an intricate system of hooks operated by the hands from the inside, so that his work can be performed without exposing any part of the body. The diver is provided with a telephone, a headlight and an apparatus which registers the amount of air sent down through the breathing tube. The wreckers from above can thus tell at all times the condition of the diver.

The science of salvage as conducted by modern wrecking companies in the raising of ships is a matter totally outside of that of raising sunken treasures. The ships laden with their treasures have for the most part been in the water so long that to raise them by compressed air would be impossible. Their rotten decks and timbers would explode and burst asunder long before sufficient air could be pumped into them to raise them from their muddy beds. Consequently the salvage of treasure-laden ships of the past is purely a matter of deep-sea diving. The diver who can go down the deepest and remain there the longest is the one who will receive the gratest reward for his venture.

Even with a diving dress that will protect the diver from the great water pressure, and with all the equipments of lights, hooks, telephone, and air registering device, the man who descends to great depths must encounter other perils of a blood curdling nature. Rotting decks and timbers may set a trap for him through which he may fall to his death. Long tunnels through deserted cabins and hulls filled with floating objects may tangle up his tube through which fresh air reaches him, and within a space of a few minutes death by suffocation follows. There are grisly wolves of the ocean to encounter in some seas, veritable man eating sharks, and other death-dealing monsters of the deep. A single false step may precipitate death, and yet time is precious and speed of action must be attained. Dark lonesome hulls must be examined, intricate cabins broken into, and not infrequently the golden treasures must be dug out of the sand and mud into which they have buried themselves. Altogether it is a grewsome experience and one that keeps the strongest man's nerves a-tingle. There are few sights which can equal the interior of a sunken ship whose ribs have been rotting beneath the ocean's waves for a century or more. Some timbers are so well preserved that they cannot be broken easily with an ax, and others so decayed that a diver can thrust a hand through them as easily as a knife goes through cheese.

The diver earns all the wealth that he gets from a sunken treasure ship, and only the hardest and most expert divers will undertake this work. They prefer as a rule to stick to ordinary wrecking in water forty to fifty feet deep.

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COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

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Inquiry No. 9053.—Wanted, address of firms who install plants to manufacture nitrogen.

Inquiry No. 9055. Wanted address of parties interested in Los Cleaning Machines.

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Inquiry No. 9066. Wanted complete outfit for export for making rice flakes and wheat-flakes.

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Inquiry No. 9069.—For the address of firms making chain cloth something like ladies' purses are made of.

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Inquiry No. 9072. Wanted machinery for making fine chains, such as used by jewelers, etc.

Inquiry No. 9073. Wanted, machinery to manufacture cocoanut oil; also the crude material.

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Inquiry No. 9078.—Wanted the address of manufacturers of sewer pipe made of fiber and asphaltum, suitable for laboratory use.

Inquiry No. 9079.—Wanted, parties to make a special steel plate rolled for "angle bars," in large quantities.

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Inquiry No. 9081. Wanted, manufacturers of a mixing machine to mix powdered and fluid ingredients to a thin dough; also molds to put such dough in to dry, the size to be about 2½ inches long, 2½ inches wide and 1½ inches high, making the form of a cake like sapolio.

Inquiry No. 9082. Wanted, the address of firms manufacturing small beer brewing plants, from 75 to 150 gallons a day.

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Inquiry No. 9094. Wanted, address of The Thomas Arithometer Company, also Burkhart Arithmometer Company.

Inquiry No. 9095. Wanted, name and address of the manufacturer of the duplex revolving pencil sharpener.

Inquiry No. 9096.—Wanted, the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted, address of makers of impulse water wheels.

Inquiry No. 9098.—Wanted name and address of the manufacturers of the ozoniser.

Inquiry No. 9099.—Wanted address of manufacturers of machinery for making wire cables.

Inquiry No. 9100. Wanted addresses of manufacturers of a dip or magnetic needle for exploring for iron ore.

Friction feed mechanism, M. Flather 950,490
Fruit juices concentrating, R. Oehme 950,930
Fruit press, S. E. Warren 950,835
Fruit treating machine, W. H. Noland 950,753
Fuel gasifying igniting and controlling the combustion of, W. Remington 951,098
Furnace, Thomson & Fitz Gerald 950,878
Furnaces, protecting registers of electric, F. A. J. Fitz Gerald 950,905
Furniture, E. C. R. Ellsworth 950,719
Furniture, school, J. C. & W. A. Moore 950,944
Fuse, electric, W. J. Lehmann 950,932
Expansible bit, A. B. Jennings 950,792
Fabric. See Knitted fabric.
Fan for drying and other machines, circulating, G. W. Schwartz, Jr. 951,029
Farm gate, O. J. Wyman 950,326
Fastening device, A. D. Field 950,892
Fastenings into work, machine for driving, G. Goldie 950,683
Faucet, C. Barr 950,801
Game apparatus, J. H. Watterson 950,610
Game apparatus, base ball, W. R. Small 950,965
Garment supporter, S. Kops 950,843
Gas engine, J. Kellington 951,070
Gas manufacturing apparatus, Renner & Kelterborn 950,779
Gases separating various materials from, W. J. Baldwin 950,607
Gate fitting, I. L. Landis 950,671
Gate operating mechanism, H. L. Coats 950,656
Gear generating machine, J. E. Gleason 950,768
Gearing, C. M. Rhodes 950,808
Gearing, transmission, W. M. Parkinson 950,822
Gearing, transmission, P. E. Clark 951,055
Gem settings, manufacturing strips of continuously connected, W. Whytock, Jr. 950,834
Girdle waist, H. W. Gilbert 950,907
Glass molding machine, W. J. Miller 950,941
Glass plates, making figured and variegated, A. C. Pilkington 950,864
Graders, dust scraper for elevating, Sprague & Wilson 950,874
Grain binder twine feeding device, J. Praska 950,958
Grass burning machine, J. R. Tolman 951,084
Grate furnace, H. Murphy 951,020
Grinder and pulper, adjustable stock power, J. Siefert 950,518
Grinder, lawn mower, J. H. Root 950,560
Grinding mill, L. E. Simpson 950,580
Grinding mill, J. Walker 950,972
Hair curler, S. A. Fisher 950,060
Hammers, Tool holder for pneumatic, V. K. Lane 951,013
Hanger. See pipe hanger.
Harvester, corn, C. A. Patton 950,824
Hay fork, E. Swan 950,875
Hay loader coupling, W. Bishop 950,867
Hay or stevedore's hook, H. Abernethy 950,687
Head rest, sanitary, E. F. Koken 950,864
Heating apparatus, L. V. Driessche 951,000
Heating device, C. Forth 950,608
Heel, detachable shoe, F. O. McCallum 951,021
Heliograph, T. J. Maher 950,984
Hide and other material working machine, Fisher & Steinhauser 950,618
Hinge, gravitating, Kussmann & Zimmerman 950,647
Hitch strap, B. Bellamy 950,470
Humidor, J. J. Deeming 950,689
Hypodermic needle, P. J. McElroy 950,822
Hypsometer, F. G. Plummer 950,805
Ice cream freezers, securing device for, J. G. Kirkpatrick 951,007
Ice cutting machine, I. Rusel 950,909
Induction furnace, I. Credit 950,911
Injector, Strain & Locke 950,774
Injector, spiral jet, G. C. McFarlane 950,808
Insulating means, producing transparent flexible and infusible, K. Winkler 950,970
Internal combustion engine, O. A. Strangban 950,683
Ironing machine, G. H. Wade 950,971
Jarring machine, Cosby & Murphy 950,803
Journal box, T. R. McKnight 950,844
Knitted fabric, B. T. Sieler 951,033
Knitting machine stop motion, F. J. Heady 950,815
Knob attachment, E. L. Teich 950,735
Ladder, L. M. Norton 951,092
Ladder, folding, M. Barth 950,469
Ladder, loose link, J. H. Berliner 950,731
Ladder, wire, Ross & Payne 950,807
Lamp, alcohol, J. H. Seaman 950,501
Lamp, electric mercury arc, J. M. Anck 950,700
Lamp for liquid combustibles, inverted incandescent, Glinicke & Zehnpfund 950,908
Lamp, gas, A. H. Humphrey 950,597
Lamp holding device, E. R. Benjamin 950,651
Lamp reflecting, W. S. Perry 950,600
Lamp socket cluster, R. B. Benjamin 950,650
Lamp socket cluster, R. B. Benjamin 950,652
Lamp socket, plural, R. B. Benjamin 950,718
Lamps, automatic controlling device for vehicle, Khlen & Rudy 950,618
Latch, compound double automatic, F. C. Anderson 950,468
Lead sulfate from impure sulfate, preparing pure, A. H. Ramage 950,677
Lifter. See bottle cap lifter.
Line holder, E. O'Brien 950,703
Linograph, T. B. Ford 950,846
Liquid meter, C. W. Monk 950,752
Liquor aging apparatus, J. Seitz 950,579
Liquors, manufacture of fermented, O. Huber 950,791
Loading apparatus, J. M. Caraway 950,588
Lock, H. F. Keil 951,098
Lock, H. F. Keil 950,936
Locomotive, internal combustion, A. H. Ehle 951,062
Loom braking device, A. E. Healey 950,917
Loom shuttle changing mechanism, M. & B. Lemarchand & V. Moutet 950,935
Loom stop motion, A. A. Gordon, Jr. 950,919
Magnet, lifting, A. C. Eastwood 950,718
Mail bag catcher, J. A. Schinner 950,870
Mail bag catching and delivering apparatus, W. H. Storms 950,562
Mail box, M. Kilian 951,090
Mail delivering apparatus, automatic, L. Becher 950,780
Mail marking machine, Stoddard & Barbour 950,921
Mantles, manufacturing incandescent, H. Summann 950,734
Manure spreader, W. N. & W. N. Whitely, Jr. 950,847
Match safe pocket, J. A. Burr 950,815
Measuring instrument, electrical, E. F. Northrup 950,613
Measuring instrument, electrical, Wohl & Hertzberg 950,067
Measuring line, surveyor's, T. H. Tracy 950,581
Meat and bone cutting machine, C. D. Nolan et al 950,696
Mechanical players, operating mechanism for, W. F. Cooper 950,582
Metallic sheathing, S. W. Banning 950,822
Milk and cream tester, H. C. Beery 950,741
Milk bottles and the like, receptacle for, J. M. Brennan 950,744
Mold, MacDougal & Chambers 950,722
Molding machine, H. B. Pridmore 950,665

Monolithic construction, [illegible]
Mop and [illegible] [illegible]
Mop wringer, [illegible] [illegible]
Motion converting mechanism, J. E. Watterson [illegible]
Motors, power transmitting mechanism for wind, F. Hausmann [illegible]
Muff, bag, and purse combination, A. S. Muller [illegible]
Nail making machine, W. Offermanns [illegible]
Nebulizer, R. E. Baker [illegible]
Nest, trap, F. J. Schlader [illegible]
Nippers and pincers, E. James 951,076
Nitrogen from the air, apparatus for producing oxide of, F. I. du Pont [illegible]
Nozzle, boiler tube cleaner, E. W. Hamann [illegible]
Nursery seat, M. A. W. Redmond [illegible]
Nut cutter, A. Loeck [illegible]
Nut lock, C. C. Blossom [illegible]
Nut lock, R. Keegan 951,076
Oil decoloring, bleaching and thickening apparatus, J. C. L. Vander Lande [illegible]
Oiling device, W. W. Nugent [illegible]
Ointment opium, T. M. Cadenhead [illegible]
Ore, sintering, G. G. Vivian [illegible]
Ores, reducing metallic oxid, H. B. T. Haultain [illegible]
Outlet box, Appleton & Hoffman [illegible]
Packing, D. F. Stayman 950,519
Pan. See Ash pan.
Paper clip, A. W. Brown 951,062
Paper feeder, automatic, J. Hren 950,074
Paper pulp refining engine, W. R. Sanburn 950,[illegible]
Paper pulp screen, Spring & Lockwood 951,[illegible]
Paper strips or the like, positive feeding device for, O. Gehring 950,764
Paper trimming machine, wall, H. L. Hellenelt 950,962
Pen, fountain, W. I. Ferris 950,617
Pen, fountain, Martling & Dunn 950,989
Pens, feed valve action for fountain, G. H. Heindselman 950,596
Pencil sharpener, O. C. Sprugler 950,797
Photograph printing machine, J. H. Cook 950,661
Photographic plates or flat films, packing for, M. Romanowicz 951,087
Piano without strings, M. North 950,794
Piling, E. A. Bern 950,696
Pin, E. R. Crecelius 950,604
Pipe and tile mold, G. Kesling 950,567
Pipe coupling, C. Forth [illegible]
Pipe coupling, air, W. J. Mills [illegible]
Pipe hanger, E. Williams 950,975
Piston, water meter, J. C. Kelley [illegible]
Planter, Beutel & Frey 951,096
Planter, wireless corn, J. Stickley 950,682
Plate holder, L. J. Vough 950,633
Plating tanks, apparatus for circulating the liquid in, G. L. Wallace 950,873
Plating tubes, W. H. Winslow 950,777
Plow, Parks & Coughlin 950,974
Plow jointer, L. M. Kieffer 951,066
Plow traction engine gang, J. W. Jackson 950,580
Plows, combined packer and harrow attachment for sulky, R. M. Markle 950,600
Plows, subsoil cultivator attachment for, R. M. Kemp 950,652
Pneumatic cleaning system, G. J. & W. Kindel 950,722
Pocket book or purse, O. A. De Long 950,[illegible]
Post card holder, C. Ewing 950,690
Powder distributer, C. H. Leggett 950,981
Powder producing an amorphous tungsten, J. Schilling 950,589
Press. See Bailing press.
Press, A. Bates 950,968
Presses, attachment for hydraulic wheel, M. M. Moran 950,573
Printing and developing apparatus, G. C. Beidler 951,045
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Projectile, capped armor piercing, Wheeler & McKenna 950,588
Propeller, J. C. Boyd 950,980
Propeller wheel, C. T. Woodburn 950,981
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Pump, J. B. Stout 950,998
Pump, T. J. Johnson 951,008
Pump attachment, E. J. Barber 950,506
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Pump, screw, S. S. Bennett 950,563, 950,564
Punches, dies, and other articles, machine for manufacturing, G. Korinek 950,782
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Shade adjuster, window, [illegible] [illegible]
Sheeting, [illegible] [illegible] [illegible]

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Splice bar, T. L. Leckland	951,009
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Supporter, Buchholz & Malloy	950,069
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Taximeter, J. W. Jones	951,077
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Telephone apparatus, D. H. Wilson	950,700
Telephone desk set, B. W. Sweet	950,800
Telephone muffler, W. D. Plumb	950,865
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Track gage, E. W. Fordyce	951,008
Track sander, W. J. Beattie et al	950,890
Track sanding device, J. Gapp	950,631
Transferring device, Reynolds & Ingle	950,067
Transmission mechanism, A. Winton	951,037
Trolley pole, H. Reed	950,630
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Turbines, blading for elastic fluid, J. S. Green 950,803	950,804
Tweezers, F. C. Wells	950,400
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Type welding machine, H. H. Steele	950,407
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Valve, W. Volkhardt	950,820
Valve, air, F. H. Bauer	951,027
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Valve mechanism for fluid engines, Van Winkle & Healey	950,641
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Vehicle driving mechanism, motor, Winton & Anderson	950,890
Vehicle motor, G. Provot	950,728
Vehicles, wind shield for self propelled, G. W. Kerr (reissue)	13,068
Vending apparatus, coin controlled, L. L. Martin	951,018
Ventilator, E. D. Chadwick	950,830
Ventilator, L. J. Carney	950,995
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Vines and other climbing plants, appliance for training pea, L. Peisler	950,689
Violin supporter, H. A. Smith	950,873
Wagon hood, collapsible, C. C. Cooper	951,069
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Watches and watch clocks, self mounting case for, E. Hart	950,780
Water elevator and distributer, R. L. Sanders	950,900
Water heater, R. W. Sawtelle	950,516
Water meter, W. H. Sitts	950,544
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Yoke center, neck, J. C. Wise	951,059

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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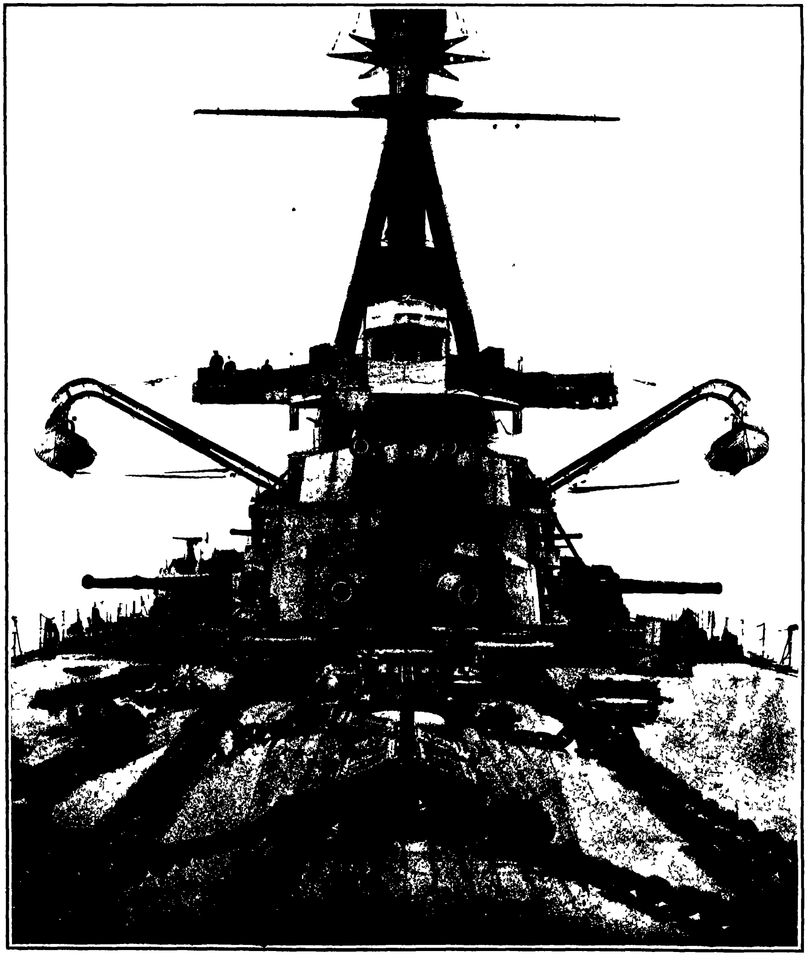

This view is taken at the bow looking aft. It shows eight 12-inch and four 4.7 inch guns trained directly ahead. This is the first ship to carry twelve 12-inch guns and she is the most powerful vessel in commission at the present time.

THE MIGHTY ARMAMENT OF THE NEW BRAZILIAN DREADNOUGHT "MINAS GERAES."—[See page 240.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A TRIUMPH OF MODERN STEAM ENGINEERING

AMONG the many brilliant successes of the steam turbine none surpasses the results which have been obtained at the Fifty-ninth Street power house which operates the heavy service of the New York Subway. Here, by the introduction of a low-pressure turbine between the low-pressure cylinder exhaust and the condenser, not only has the output of the present reciprocating engine been doubled, but there has been made possible an increase of nearly 150 per cent in the economic capacity of the whole plant.

In a recent issue of the SCIENTIFIC AMERICAN we gave a preliminary statement of the truly remarkable work which is being done at this station. At that time one of the turbines was in place and the tests had not been carried to full completion. In the interim, more complete data have been secured, and at the last meeting of the American Society of Mechanical Engineers a paper was given by H. G. Stott, Superintendent of Motive Power of the Interborough Company, and I. S. Pigott, in which a very complete statement of the installation and its results was made public.

During 1908 it became apparent that the rapidly increasing traffic in the Subway would render it necessary to provide additional power for the winter of 1909-1910. The main power plant consisted of nine 7,500-kilowatt (maximum rating) compound Corliss engines and three 1,250-kilowatt turbine units for lighting and signal purposes. Of these engines and generator units the authors of the paper say: "In general they are the most satisfactory large units ever built, as five years' experience with them has proved."

In considering the problem of securing an additional supply of power, electric transmission of power from a hydraulic plant was rejected because of the high cost of a double transmission line from the nearest available water power and the impossibility of getting reliable service.

The gas engine, it will surprise many of our readers to learn, while offering the highest thermodynamic efficiency, would have cost at least 35 per cent more than an ordinary steam turbine plant, and its maintenance and operation account would have been from four to ten times greater.

The alternative of building more reciprocating engines of the type already installed was rejected (in spite of their most satisfactory performance) because of the high first cost and the small range of economical operation (between 3,300 and 8,300 kilowatts), the water rate rising very rapidly beyond these limits.

As between the installation of high-pressure and low-pressure turbines, it was found that by combining a low-pressure turbine with the present engine at least 8 per cent higher efficiency would be secured than with a high-pressure turbine unit alone, and it was finally decided to place an order for one 7,500-kilowatt (maximum rating) turbine unit, since by this means "the company would not only get an increase of 100 per cent in capacity of the combined engine and turbine," "but at the same time give the engines a new lease of life by bringing them up to a thermal efficiency higher than that obtained by any other type of steam plant."

The net results obtained with this first installation are summarized as follows: An increase of 100 per cent in maximum capacity of plant, an increase of 146 per cent in economical capacity of plant, a saving of approximately 85 per cent of the condensed steam for return to the boilers, an average improvement in economy of 13 per cent over the best high-pressure turbine results, an average improvement in economy of 25 per cent (between the limits of 7,000 kilowatts and 15,000 kilowatts) over the results obtained by the engine units alone, and lastly, an average unit thermal efficiency between the limits of 6,500 kilowatts and 15,500 kilowatts of 20.6 per cent.

These results are surely entitled to be considered as constituting the low-pressure turbine one of the greatest triumphs of modern steam engineering.

AN AMERICAN GIBRALTAR

KEY WEST, by virtue of its geographical position, stands in the same strategic relation to the Gulf of Mexico and the Caribbean Sea as does Gibraltar to the Mediterranean, and its naval and military importance, which have always been recognized, have been greatly increased by the results of the late Spanish war and the construction by the United States government of the Panama Canal. The transformation of Key West into a great naval and military station which shall rival in importance the fortress of Gibraltar is advocated at considerable length in an article by Commodore W. H. Beehler, U. S. N., Commandant of the Seventh Naval District, which appears in the March number of the Journal of the Military Service Institution. The first part of the Commodore's paper is devoted to an urgent plea for the more complete co-operation of the army and navy forces. The army and navy should be as intimately connected as are the navy and the marine corps, and this connection should include, as far as possible, both the personnel and material. Guns and ammunition should be of the same general type, with the latter interchangeable and supplies and stores should all be of one standard. It is admitted that close relations between the army and navy would be subject to certain limitations, but the Commodore urges that it is essential that the coast artillery corps and the navy should be intimately associated for the efficient defense of our seaboard. There should be a definitely assigned portion of the navy to act as Navy-Coast-Defenders, and in this class should be included second-class battleships or older battleships, the smaller torpedo boats, scouts, submarines, mine-laying vessels and tugs. "Their co-operation in the defense of any particular naval base should be definitely arranged in time of peace and they should maneuver and drill *now*, under the command of a designated officer of the coast defense service, whether he be an army or a naval officer."

In his proposal to make of Key West an impregnable Gibraltar, it is pointed out that the present defenses at Fort Taylor are inadequate for the reason that battleships can lie at the entrance buoy seven miles south of Fort Taylor, beyond the range of the 12-inch rifle mortars, and destroy Key West from that point without being exposed to any danger the remaining velocities of projectiles from the direct firing 10-inch and 12-inch guns being insufficient to penetrate the armor of any battleship, whereas these same caliber guns on a battleship could shell the city of Key West and completely destroy it.

This consideration brings the Commodore to his novel proposal for rendering Key West impregnable. He points out that in place of high hills or a huge rock as at Gibraltar, for the mounting of coast defense guns, Key West Harbor, twenty-five miles in length, is sheltered on the north by a line of low reefs and shoals which form a complete protection on that side, while seven miles to the south of this line there is a parallel line of eastern shoals, some of which are scarcely awash at low tide and none more than eight feet above high water. To build forts on these outer reefs would be so costly that it could scarcely be considered, but Commodore Beehler proposes to take our monitors and older battleships which have passed their period of usefulness on the high seas, mount them in selected positions upon these reefs, and utilize them as permanent turret forts. Thus, for instance, selecting the shoal known as Rock Key, where there is a small natural harbor, he would lighten the old monitor "Amphitrite" by the removal of her propelling engines, haul her into the harbor, build around the vessel a dyke of piling, rock, and riprap, and then fill in the space between the inner face of the dyke and the ship with material hydraulically dredged and deposited. He estimates that the work would not cost more than $50,000, and he claims that the sea-coast defenses would thus be increased by a double-turreted fort containing four 10-inch breech-loading rifles and provided with admirable protection. The vitals of the fort, that is the ammunition rooms, turret turning gear, etc., would be protected not only by the armor of the ship but also by many feet of the inclosing earth and riprap. The deck of the monitor would be about eight feet above mean low water, and the riprap would be carried up the sloping face and over on board, leaving only the turrets and superstructure exposed.

The ship as thus imbedded would furnish, says the Commodore, a complete, modern double-turreted fort, with every necessary feature to operate the guns, and with quarters for the officers and men of the garrison, and moreover, the entire cost of the installation would be less than the cost of maintaining such a ship in the navy for one year. The monitors "Miantonomah," "Terror," and "Puritan" could be installed upon the adjacent reefs, and the range of the sixteen 10-inch and 12-inch guns of these forts would command a large part of the Straits of Florida, and especially that part which is used by westbound vessels entering the Gulf of Mexico which navigate close to the Florida reefs to avoid the strong current of the Gulf Stream. Incidentally, it may be mentioned that the dyke would be extended in each case to form a small harbor of refuge for torpedo boats and submarines. Referring to the proposed island fortifications for the defense of the entrances of the Chesapeake it is suggested that it would be a great economy if one of our old battleships such as the "Oregon" were used as a central point about which the island could be built.

Now, it is a question of great interest and of unquestionable moment, whether this very novel proposal of the Commodore does not provide an opportunity to greatly lengthen the useful life of the battleship. In view of their enormous and rapidly growing first cost the rapidity with which these instruments of war depreciate in military value is something appalling. In a few years after their completion they are unfit to lie in the first line of battle, in ten years time they are becoming obsolete, and in fifteen years' time they must be relegated to the limited rôle of coast defense. The depreciation is not in the guns and armor but in the motive power, speed, and coal capacity. Many of these obsolescent ships, because of their powerful armor and armament, would be perfectly well able to stand up in the first fighting line, if they only possessed the requisite speed and maneuvering quality, and if it should be found practicable to utilize them in the way suggested by Commodore Beehler, their powerful guns and heavy protection would render them most formidable when mounted as part of the permanent fortifications of our sea-coast defenses. This suggestion is certain to excite a widespread interest, and we commend it for discussion in our columns by that large and ever-growing circle of our readers who follow closely the development of naval and military material.

PAULHAN'S FLIGHT NEAR NEW YORK

AVIATOR LOUIS PAULHAN succeeded last week in getting the bond which he is required to put up in case he flies reduced to $6,000 for one week, and on Friday, March 11th, he made two exhibition flights at the race track near Jamaica, L. I., before some 300 invited guests. Wilbur Wright and his lawyers were interested spectators as it was thought that M. Paulhan would attempt to fly with his vertical rudder tied or else without using the stabilizing flaps or ailerons. There was an 8 to 10-mile breeze blowing, and by starting against the wind Paulhan left the ground after a run of about 75 feet. He rose rapidly, and in the course of the two circuits of the track, made in 2:44, he reached a height of 75 to 100 feet. The biplane flew well and was not affected appreciably by the wind. Despite the sharp turns the machine did not tip very much in making them. It appeared to rock and pitch slightly, but was always under perfect control. The descent was made rapidly and at an angle of about 20 degrees. M. Paulhan made two more circuits in 2 minutes and 38 seconds.

REQUIREMENTS FOR THE SCIENTIFIC AMERICAN TROPHY FOR 1910.

THE third annual competition for the handsome trophy given in 1907 to the Aero Club of America by the publishers of the SCIENTIFIC AMERICAN is now open to all aviators. As aviation has at last reached a stage where cross-country flights of a considerable distance are being made, it has been decided to award the trophy for 1910 to the aviator who makes the longest cross-country flight in excess of 50 miles, which has been fixed as the minimum distance. A round-trip flight of 25 miles each way will also fulfill the conditions. The flight may be made at any point in the United States that is convenient for the aviator, who must notify the Aero Club of America or the SCIENTIFIC AMERICAN a sufficient time in advance to allow of the sending of a representative of the club to officially observe it. The competition is international, and foreign aviators are invited to compete for the trophy whenever occasion allows.

The dates of the international balloon and aeroplane races for the Bennett trophies have been fixed by the Aero Club of America. The balloon race will be held at St. Louis on October 17th, and the aeroplane race above the Hempstead, L. I., plains (probably) on October 22nd. Plans are also on foot to hold big aviation meets at San Antonio, Texas, in April, at Atlantic City, N. J., in July, and at St. Louis in October.

ENGINEERING.

The United States army has recently adopted a new type of machine gun which can be carried by one man, while two such guns with a full equipment of stands and ammunition can be packed upon a mule The new weapon can be fired from the shoulder The barrels are carried in duplicate, and can be rapidly changed when they become heated from continuous firing

In a recent communication to Flight on the relative military value of aeroplanes and airships, Col Capper of the British army believes that the improved aeroplane will have the dirigible at its mercy He predicts that the future aeroplane will be able to ascend to heights of 10,000 feet and over, from which it will swoop down and destroy the more slowly moving dirigibles below

The New Haven Railroad has proposed to the city of Boston to enter into the joint construction of a tunnel between the North and South stations in that city They offer to spend $16,000,000 on the construction of the tunnel which is to be electrically operated, provided the city will bear the expense of $10,000,000, which it is estimated will be the cost of the purchase of the necessary land

One of the most remarkable features of the New York Public Library, now slowly nearing completion, will be the huge stack room, 90 feet wide, 300 feet long and 60 feet in height, containing seven tiers of stacks The metal work of the stacks alone weighs about 3,000 tons, and recently, in estimating for the painting contract it was found that merely to pass once through the multitudinous nests of stacks it would be necessary to cover seven miles of distance

The last annual report on the shooting in the British navy shows that the percentage of hits to rounds fired during 1909 was 64 67 In 1905 it was 20 02, in 1906, 34 60, in 1907 35 81, and in 1908, 58 12 The significance of these figures will be evident when it is stated that in 1907 the size of the target was greatly reduced, the number of hits in that year being consequently only slightly greater than in the year preceding

The placing of a large order by the Admiralty for liquid fuel has led to exaggerated statements in the London Express to the effect that the British navy contemplates the practically exclusive use of oil fuel There is no truth whatever in this statement A few hundred tons of oil will be carried in future battleships as an auxiliary to coal and oil will continue to be used as fuel in certain classes of torpedo boats Great Britain possesses no such extensive oil fields as would warrant a drastic change of this character

A general scheme for constructing a north breakwater to the entrance of the Panama Canal has been approved, and the preparatory work is being done The breakwater will protect shipping in the harbor at Colon, and will shelter vessels which are making the north entrance to the canal from the violent 'northers' which prevail from October to January There will be two jetties of rock, which will extend from Toro and Manzanillo points until they reach depths of water of 48 and 44 feet, respectively

Some injudicious statements were made recently by Representative Rainey about the new 14 inch coast defense gun, which is undergoing test at Sandy Hook, in the course of which he spoke of the gun as having 'burst' on trial As a matter of fact, the gun has shown excellent results, and given much satisfaction to the army men The accident, which was a trivial one, consisted in the breaking of a part of the mechanism of the disappearing carriage, which delayed the tests only a few days, and was quickly made good

It is now officially stated by the Pennsylvania Railroad Company that the four tubes under the East River and the electric service as far as Jamaica will be placed in operation on May 15th. The trains will run, under a five-minute headway, from the new terminal at Thirty-third Street to Jamaica without a stop, in 18 minutes. The main yard, station, and offices on Long Island will be built at Jamaica, where $3,000,000 will be expended for this purpose The tunnels to New Jersey will be in operation by July 1st, and the lines along the north shore to Great Neck early in January, 1911.

In London Engineering Mr A A C. Swinton describes a model steam-propelled aeroplane built by C A. Parsons of turbine fame, which made successful flights in 1893, thus antedating the Langley aerodrome by three years. The boiler, 2½ inches in diameter, supplied steam to a cylinder 1¼ by 2 inches, the total weight of engine, propeller, and water being 1¼ pounds. The aeroplane consisted of two wings and a tail built of a silk-covered, cane framework, the whole apparatus with engine weighing 3½ pounds. The model made several flights of about 100 yards distance, coming down when the steam pressure was exhausted The boiler, which carried 50 pounds, was heated by a spirit lamp.

ELECTRICITY

In an article in La Revue Electrique, on the effect of high temperature on insulating materials used in dynamo-electric machinery it was pointed out that cotton does not show any injury when exposed to temperatures below 105 deg C, but that at 115 deg C it begins to deteriorate and above 125 degrees it rapidly disintegrates

The reputation for efficiency of the New York telephone service has spread all over the world In Paris the service has been so poor of late that the subscribers have organized to demand improvements. Quite recently the Ministère de Postes et des Télégraphes of France applied to the vice-president of the New York Telephone Company, asking if he would be willing to train six telephone officials from Paris in the various methods employed in New York The request was gladly acceded to

An office was recently opened in Chicago by the Telepost Company which employs the Delany rapid telegraph system As described some years ago in the SCIENTIFIC AMERICAN, a perforated paper tape is used, by which the signals are transmitted over the line at high speed To avoid the overlapping of successive signals because of the line capacity, each signal is made up of a positive impulse followed by a negative impulse At the receiving station the message is recorded on a chemically prepared tape

A recent number of the Electric Railway Journal describes briefly a peculiar electric locomotive used for canal haulage near Bremen The locomotive runs on a quay, which has to be kept clear for the passage of drays In order to secure the requisite weight for adhesion, the locomotive is built in the form of two inverted U's connected at the top with a girder The width of each base is only 28 inches and so the driving motor had to be placed in the upper part of the structure The locomotive thus straddles the traffic and can travel up and down the quay without disturbing the trucks, which pass between the U's and under the connecting girder

A special type of motor has been built for a British powder factory in which precautions have been taken to render the motor flame proof and explosion proof The motor case is very strongly built, so that it will stand explosion of dust or gases which might find their way into it The joints of the motor case are packed with hemp rope dipped in tar this being considered more durable than rubber at high temperatures The bearings are also specially packed to prevent the escape of hot gas in case of explosion within the motor No ventilation for the interior of the motor is provided, but the casing is formed with corrugations which furnish a large cooling surface

In the discussion which followed the reading of a paper on underground conduit construction for large transmission systems before the American Institute of Electrical Engineers in Chicago the following illustration was given to point out the advantages of concrete over tile because of its lower thermal conductivity and its better heat resistance A burn-out occurred in a 1 000 000 circular mil 230-volt cable in the middle of a 9-duct outlet from a manhole On examination it was found that the conductor had been completely consumed, but the concrete was burned to only a quarter of an inch while the cables in the ducts above and below showed not the slightest injury Had tile been used instead of concrete, the heat developed would have been sufficient to damage the conduit very seriously

The naval gun factory at Washington, D C is equipped with six cranes four 60 ton cranes on the first track, a 110-ton crane on the next track above and a 200-ton crane on the third track which is 160 feet above the ground floor The track is 500 feet long running the full length of the gun factory The shrink pit is located at one end of the shop making it a difficult matter to call a certain crane Accordingly an annunciator system has been installed on each crane with a push button for each crane located on a board close to the pit. These buttons are connected to the annunciator in the crane cab by light trolley wires strung along the web of the I beam that supports the cranes In this way either crane can be called by pushing the button If the crane is busy the call will show on the annunciator

The very first day of the inauguration of letter telegrams proved the success of this method of communication and gave promise of a great future The principal business was done between the large commercial centers, such as New York, Boston, Chicago, St. Louis and New Orleans By this system a 50-word message may be sent at night at the price of the ordinary 10-word message At the receiving end the message is deposited in the nearest post office for delivery by the first morning mail Thus the wires are kept as busy at night as in the daytime A great deal can be said in fifty words, so that quite a lengthy message can now be sent to distant points in less time and cost than formerly

SCIENCE.

On March 6th Vesuvius suddenly became active again There was a continuous eruption for twenty four hours of red hot stones and ashes, accompanied by internal detonations Several fissures opened, from which gas and lava emerged in great quantities

Prof. Wilhelm Trabert has been appointed director of the Central Institute for Meteorology and Geodynamics at Vienna, succeeding the late Prof Josef Maria Pernter As director of this institution he is the official head of meteorology in Austria

Dr. Felix Exner of Vienna has completed the great treatise on meteorological optics begun by the late Prof J M Pernter in 1902, about two-thirds of which had been published up to the time of Pernter's death in 1908 It is the only extensive modern work on this subject

The commission appointed to examine the Leaning Tower of Pisa has reported that it thinks its foundations may need strengthening A spring exists under the tower, the water of which is raised by steam pumps for the use of a local factory As the bed of the spring is emptied, it is feared, a subsidence of the ground on which the campanile stands will follow

Dr Herman C. Bumpus, director of the American Museum of Natural History announces that up to last August, at least, V Steffansson and R M Anderson, the museum's Arctic explorers were safe A letter from Mr Steffansson, from Herschel Island in the Arctic Ocean dated August 19th 1909 has been received telling of the adventures and successes of the party

The task which the American south polar expedition had set itself to perform in the opinion of Sir Ernest Shackleton was much harder than was generally recognized inasmuch as no one had ever landed in the place where the exploring party purposed to land Indeed no one had ever seen land there although there was an ice cliff 150 feet high which was called land Still, Americans might find land in that locality

Dr Le Paguays recommends a process of disinfection which consists in blowing upon the contaminated surfaces a current of air heated to a very high temperature (600 to 900 deg F) This process may be applied not only within buildings, but also to the surface of streets, yards, etc The apparatus is heated by petroleum and is very simple This process not only destroys disease germs but it is very efficacious against fleas and other vermin

Kuhne has devised a process for the manufacture of sulphuric acid based upon the employment of the ultra-violet rays emitted by mercury vapor lamps. A mixture of air and sulphurous acid gas is introduced into a tower, lined with lead, into which water is injected in fine jets Under the influence of the ultra-violet radiation of lamps in the tower, the sulphurous acid is entirely converted into sulphuric acid Several towers are connected together The strength of the sulphuric acid solution obtained in the first tower can be increased by spraying it instead of water, into the second tower In like manner, the product of the second tower is sprayed into the third, and so on In the last tower however pure water is again used as soon as any sulphurous acid appears in the escaping gases

The Zeppelin North Polar Exploration Committee met recently under the Presidency of Prince Henry of Prussia Count Zeppelin, Prof Hergesell and Prof Lewald were among those present The committee discussed the programme for the summer's work which will be devoted to a preliminary expedition for the purpose of studying ice conditions The government will be asked for the use of the exploring vessel "Poseidon" for about two months The expedition will start for Spitzbergen July 1st on an excursion steamer, and there will transfer to the Poseidon A Norwegian ice steamer will be used for the purpose of forcing an entrance into the polar ice and the expedition will return at the end of August Apparently no airship will be taken for summer use

For once the bacteriologists and hygienists, who usually appear to delight in alarming timid folk announce a discovery which will reassure those persons who are afraid to eat green vegetables Manau thought that he had discovered soil microbes in the interior of vegetable stalks From this discovery resulted the condemnation of sewage farms and, indeed, of all market gardening as it is ordinarily practised, with the employment of manure Fortunately this opinion has not been shared by all bacteriologists. In order to solve this problem which is so important from the hygienic point of view, Remlinger and Nouri have undertaken a series of experiments, in which they endeavored, by every possible means, to infect plants with microbes In every case however, they found it impossible to obtain colonies of microbes from the interior parts of the plants thus infected Hence they conclude that the microbes in the soil do not penetrate into the interior of plants, but remain entirely upon the surface

NEW AEROPLANES AT HOME AND ABROAD

THE "BADDECK NO. 2" AEROPLANE.

A noteworthy aeroplane so far as actual flying is concerned is the "Baddeck No 2" of Messrs McCurdy and Baldwin, who are still working with Dr Bell near Baddeck, Nova Scotia. As our photographs show, this biplane is an excellent flyer. It has made a considerable number of more or less lengthy flights above the ice of Lake Bras d'Or, in a number of which passengers were taken.

The planes of the McCurdy and Baldwin machine are 40 feet long by 7 feet wide at the middle, decreasing to 5 feet at the ends. The wing tips which are double and attached at each end of the main planes, are about 5 by 5 feet in size. They are hinged near their front edges, and rocked in the usual manner by means of a fork fitting around the aviator's shoulders. The horizontal rudder consists of two superposed surfaces spaced 30 inches apart, and mounted 15 feet in front of the front edge of the main surfaces. The surfaces of this rudder are 12 feet by 28 inches in size. A biplane tail is also used, the planes being the same size as those which form the front rudder. This tail is mounted 11 feet from the rear edge of the main planes. The horizontal and vertical rudders are operated by a wheel in the same way as on the Curtiss biplane. In other words, a push forward or a pull backward on the wheel directs the machine downward or upward. Turning the wheel to the right or left steers the machine sideways.

The motive power of this biplane is a 6-cylinder Kirkham automobile motor of 40 horse-power. It is water cooled and develops its rated power at 1,400 R.P.M., at 2,000 R.P.M. it develops 48 horse-power. The radiator is novel, consisting of thirty flattened tubes 7½ feet long by 3 inches wide by 3/32 inch thick. These tubes are curved from front to rear in the same manner as the main planes, and sufficient lift is obtained to support the weight of the radiator and water carried. The motor is geared to a single 7 foot 8-inch propeller having a 6 foot pitch, by means of a chain, the ratio being 3 to 5. The thrust obtained is sufficient to drive the machine at a speed of over 40 miles an hour.

The chief features of Messrs. McCurdy and Baldwin's biplane are the use of a comparatively heavy 6-cylinder automobile motor and the fitting to the machine of a biplane tail of the same shape and size as the horizontal rudder. The 6-cylinder motor has been found superior to the 4-cylinder for automobile work, but this is the first aeroplane, so far as we know, to be fitted with this type of motor. The motor is placed low down upon the lower plane in order to keep the center of gravity low while the propeller is mounted higher up, so that the center of thrust shall be as near as possible to the center of resistance of the aeroplane. The usual three-wheel chassis, first used by the Aerial Experiment Association, of which Messrs. McCurdy and Baldwin were members, is fitted to the machine.

After making numerous satisfactory flights above the frozen surface of the lake, Messrs. Baldwin and McCurdy were visited on the 9th instant by Major Munsell of Ottawa, who represented the military department of Canada. The two inventors made five exhibition flights for this officer, and finally he consented to make a flight as passenger with Mr McCurdy. A very satisfactory flight of several minutes' duration was made. Messrs. McCurdy and Baldwin made a number of flights last summer and fall in Canada, and the Canadian government is very much interested in their machine, and will doubtless eventually purchase one for military use. The noteworthy point about this machine is that its makers have built it sufficiently large to carry a weighty and reliable motor, and there is little doubt that the machine is capable of making extended flights without difficulty.

The Herring Biplane, showing novel stabilizing fins.

This new biplane has several new features, such as foot operation of the horizontal rudder, fins for automatic transverse stability, a skid instead of wheels, etc.

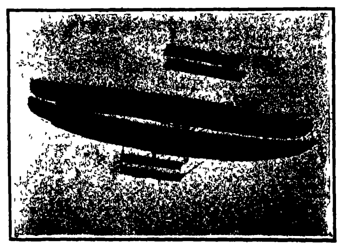
THE NEW HERRING BIPLANE.

The best constructed aeroplane on exhibition at the Boston show, as noted in previous issues of this journal, was the new biplane of A. M. Herring. The photograph of this machine, reproduced above, was taken at the time of the trial flight on March 1st, and it gives a very good idea of the biplane's novel features. The spread of the planes is about 28 feet, and the fore-and-aft width about 4 feet, the total supporting surface being 220 square feet. A 25-horse-power Curtiss motor is mounted upon the lower plane at the rear, and carries upon its crankshaft a 4 bladed 6-foot propeller of 5-foot pitch, designed by Mr Herring. The total

(Continued on page 246.)

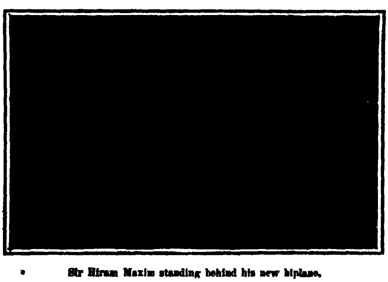
Capt. Baldwin's novel biplane.

The rudder above the upper plane is worked by a fork fitting about the aviator's shoulders. It corrects the side-tipping of the aeroplane.



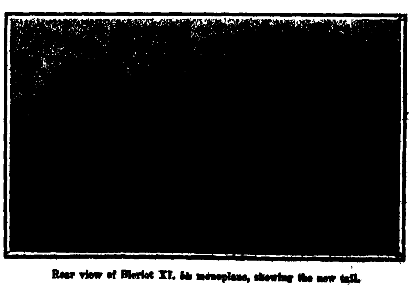
Messrs. McCurdy and Baldwin flying in their "Baddeck No. 2" biplane.

This is the first aeroplane to be equipped with a six-cylinder automobile motor. It has made many successful flights in Canada.



Sir Hiram Maxim standing behind his new biplane.

This machine is similar in many respects to the inventor's gigantic aeroplane built nearly 20 years ago.



Rear view of Bleriot XI, his monoplane, showing the new tail.

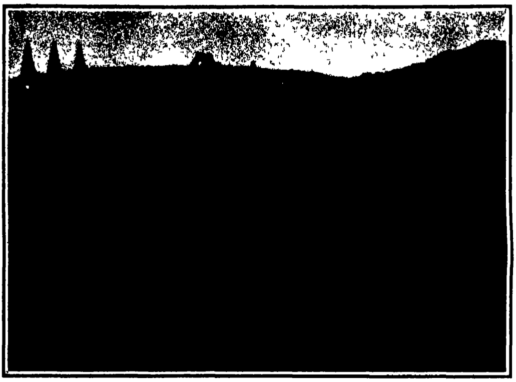
Note the complete covering of the body, and the large horizontal rudder at the rear end of the tail.

NEW AEROPLANES AT HOME AND ABROAD.

BUILDING THE OLIVE BRIDGE DAM FOR THE CATSKILL WATER SUPPLY.

Work on the Catskill water supply, which will provide New York with five hundred million gallons of water daily, is making steady progress, as will be evident from the illustrations of this work which are herewith presented Briefly stated, the scheme consists of the construction of a large reservoir in the Esopus watershed in the Catskills, with a storage capacity of 127 billion gallons and an aqueduct 92½ miles in length for conveying the water to the New York city line The Ashokan reservoir, as it is called, will supply the city with 250 million gallons daily in addition to the 375 million gallons now available in the reservoirs of the Croton watershed As the future needs of the city demand it, reservoirs will be built in the Rondout and Schoharie watersheds adjoining the Esopus Valley and from these three dams it will be possible to draw sufficient water for the full capacity of 500 million gallons daily of the new aqueduct The latter passes through the Croton watershed and in two years time, and before the full completion of the Ashokan reservoir, a portion of the water stored therein will be available for delivery through the new aqueduct to the new Croton dam The work is to be completed by February, 1915

The Olive Bridge dam which will create the Ashokan reservoir, is a huge structure with a maximum height from the lowest foundation of 240 feet and a width along the crest of 4 830 feet The central portion immediately above the river is built of cyclopean masonry and extends for 1 000



Present condition of Olive Bridge dam as viewed from north bank.

A completed section of the 92½-mile steel-and-concrete aqueduct

Upstream side of Olive Bridge dam, diversion tunnel for carrying river during construction

Site of dam, showing the 9-foot pipes for passing river through the work.

Placing steel reinforcement for the concrete aqueduct.

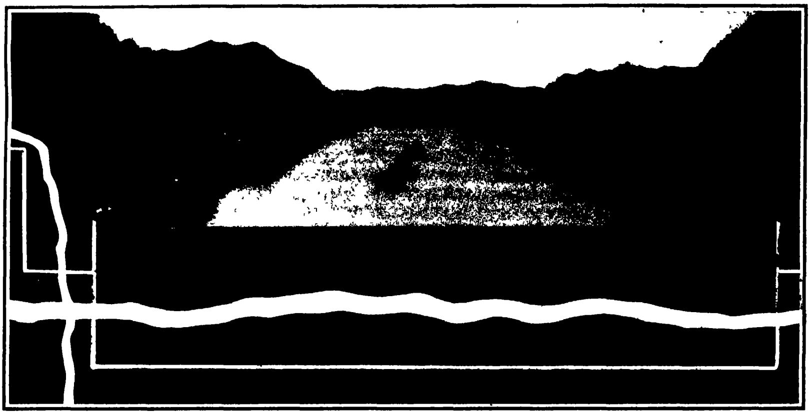
BUILDING THE OLIVE BRIDGE DAM FOR THE CATSKILL WATER SUPPLY.

feet in width. The rest of the dam consists of a central masonry core wall and carefully laid and rolled earth. In addition to the main dam there are two series of embankments known as the Beaver Kill and Hurley dikes, the former extending for 11,144 feet and the latter for 2,200 feet. In addition to these works there is a waste weir 1,100 feet in length and a dividing dike and weir 2,200 feet long. Taken altogether, the masonry and earthworks necessary to close the valley depressions and raise the water to the desired height measure five and one half miles in aggregate length.

had been reached, a large culvert, 35 feet wide by 40 feet high, of sufficient size to take care of any possible floods coming down the valley, was formed in the wall of the dam. As soon as the vertical walls had been carried up a sufficient height to accommodate the river, the latter was diverted through the culvert and the 8-foot pipes were removed. Some interesting work was done in building the roof of the tunnel, a series of framed steel brackets or cantilevers being placed on each side of the opening, from which the wooden forms for the arch of the tunnel were suspended. Then as the masonry was laid, a series of

above mean sea level. Its thickness will be 28 feet at the crest, its maximum thickness at the base about 200 feet, and the masonry work will contain 550,000 cubic yards of material. The maximum width of the earth-and-core-wall wings of the dam will be about 800 feet, their top width, about 34 feet, and the total quantity of embankment will be about 2,000,000 cubic yards. The elevation of the discharge will be 590 feet above tide level.

The Beaver Kill dikes, which have a total length of about 2.8 miles, will have a maximum height of about 110 feet above the original surface, and they will con-



Cross-section of the Hudson River near Cornwall, showing how the Catskill water supply will be carried under the river in a pressure tunnel in the solid rock 1,200 feet below tide level

The accompanying photographs, for which we are indebted to the MacArthur Brothers Company, who have contracted to build the main dams of the Ashokan reservoir for over twelve and a half million dollars, serve to illustrate the character of the work. The earliest of the operations consisted in providing a bypass in the form of two 8 foot steel pipes for carrying the flow of the Esopus Creek past the dam during the work of excavation, and the construction of the masonry up to the level of the river. When this level

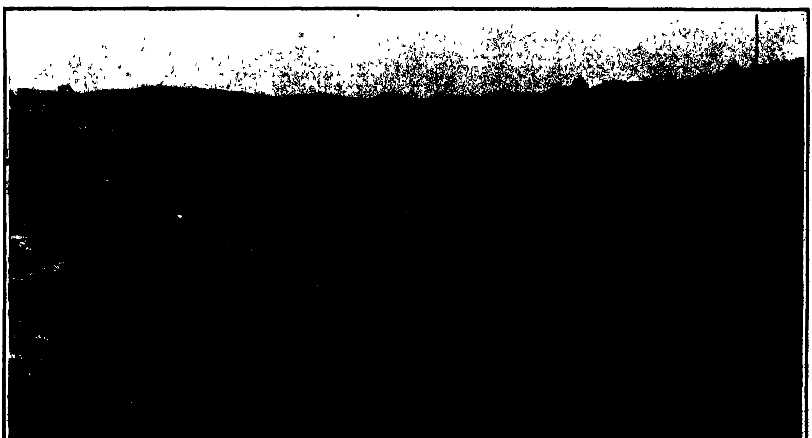
heavy steel I-beams were placed transversely to the axis of the tunnel from which the forms with their superincumbent load of masonry were suspended by vertical tie-rods. To facilitate the flow of the water, the wooden forms will be left in place until the dam is completed. Then the flow will be diverted, and the tunnel will be filled in with masonry. When this is completed, the filling of the reservoir will take place.

The top of the Olive Bridge dam will be 610 feet

tain about 5,000,000 cubic yards. Like the earthen portions of the Olive Bridge dam, they will be built with a concrete core wall. The reservoir will be divided by a dike into two basins. This dike will have a length of 1,100 feet, and the dividing weir will have the same length.

It will be readily seen from these figures that the Ashokan works are on an immense scale. They involve over 2,000,000 cubic yards of earth and 425,000

(Continued on page 249.)



Valley of the Esopus. Dam in foreground with river flowing through completed portion of temporary tunnel.

BUILDING THE OLIVE BRIDGE DAM FOR THE CATSKILL WATER SUPPLY.

An Important German Patent Decision.

A very important case was recently decided by the Supreme Court of the German Empire, First Civil Senate, in which the rights of American patentees in Germany are defined The facts in the case are briefly these

The National Cash Register Company of Berlin, a limited liability company incorporated under the German law, is the owner of three German patents. In Germany the patentee must work an invention within three years from the date of publication That term had expired for all four patents Proceedings were instituted by Schubert & Salzer Machine Works in the Imperial Patent Office to revoke these patents on the ground that they had not been worked to an adequate extent in Germany, and that in all their essential parts the cash registers protected by the patents were manufactured by the National Cash Register Company of Dayton, Ohio, and were imported from the United States into Germany In its defense the National Cash Register Company of Berlin stated that one German patent had been worked in Berlin, and that this patent was in substantial agreement with the American patent covering the identical points of invention, that the other three patents were not worked in the German Empire, but that their revocation would not serve any public interest The Imperial Patent Office revoked all four patents, arguing that the one patent which was worked in Germany was not identical with the American patent cited by the defendant

The National Cash Register Company appealed from the decision of the German Patent Office on the ground that the German Patent Office erred in holding that the German patent alleged to be identical with the American patent was not worked in Germany, and still setting up the old defense that the revocation of the remaining three patents would not further public interest Pending the appeal the National Cash Register Company of Berlin changed its firm name so that it read National Registrierkassen-Gesellschaft mit beschraenkter Haftung All four patents were assigned by this new company to the National Cash Register Company of Dayton, Ohio, so that the patents no longer belonged to a German but to an American firm Pending the appeal, one patent became void for failure to pay the annual tax, and another patent was abandoned There remained for consideration the validity of the German patent which was worked and which was alleged to be identical with the American patent, and another German patent which was not worked The National Cash Register Company of Dayton, Ohio, on petition was permitted to interplead as a party to the suit in place of the German company because it was the assigner of the patent rights

The first question which came up before the court was whether the American company could be permitted to act as the defendant on appeal in view of the fact that the German company had been the defendant when the action was brought before the German Patent Office The point depended upon an interpretation of Section 265 of the German Civil Code The Supreme Court decided that it was not a violation of that section of the Civil Code to substitute the American company for the German company as defendant The forfeiture of the patents involved a consideration of the treaty of February 23rd 1909 between the German Empire and the United States of America relating to the mutual protection of industrial property That treaty became a German law on August 1st, 1909, and affected the patents which had been assigned to the American company The treaty provided in substance that the American patents of Germans and the German patents of Americans were to be restricted in their respective countries only so far as they were restricted by the opposite contracting party's laws The German patent law compels the working of patents in the German Empire on pain of forfeiture within three years. On the other hand, there is no law in the United States to compel the working of patents The court therefore holds that the treaty exempts American citizens from the obligation of working their German patents in Germany because German citizens are not compelled to work their American patents in the United States Hence, because the patents for which forfeiture was demanded were the property of an American company, the decision of the German Patent Office was reversed.

As a result of this very important decision, an American citizen stands in a better position before the German courts, so far as forfeiture is concerned, than a German subject. It is usually the object of a treaty to secure equal rights to the contracting parties, but in this case it would seem that a very liberal interpretation of the treaty gives to American citizens probably more than they originally bargained for

The Current Supplement.

The opening article of the current SUPPLEMENT, No 1785, is by L. A. Bauer, Director of the Department of Research in Terrestrial Magnetism, in which he describes the instruments and methods of the ocean magnetic work of the Carnegie Institution of Washington The article is elaborately illustrated. Extracts from affidavits submitted in the case of Wright vs Paulhan, as well as Judge Hand's decision, are given In this decision the Farman, Blériot, and Wright machines are considered from the patent lawyer's standpoint The Berlin correspondent of the SCIENTIFIC AMERICAN writes a fascinating article on the number of particles projected by cathodes It seems almost incredible that invisible particles smaller even than atoms can be counted, and yet in this article the method of so doing is described Prof K Svehla points out the disinfecting qualities of a sad iron The powerful passenger and freight locomotives of the Mallet type recently built for the Atchison Topeka and Santa Fe Railway are described W P Draper's article on the artificial silk industry is continued P H Cowell writes on Halley's comet as seen from the earth He gives a table of ecliptic coordinates in two decimal places at intervals of four days through an arc extending from one end to the other of the *latus rectum* of its orbit, as well as a diagram giving the position of the earth for six days in May, also the position of the comet on twenty seven days measured from perihelion passage in days Some novel toys are described and illustrated

A German Antarctic Expedition.

A German south polar expedition has been virtually arranged by Lieut Filchner of the General Staff, under the auspices of the Geographical Society Lieut Filchner announced at a meeting of the society that the expedition would start in October of this year if the necessary funds were forthcoming

The plan is to send a vessel with provisions over the route followed by Lieut Shackleton and form a depot at about the half way point to Shackleton's winter headquarters The regular expedition would start later from Weddell Land on the opposite side of the pole and make a dash across with the depot as objective

Dr Penck, chairman of the Geographical Society announced that an anonymous donor had given $75,000 toward defraying the cost of the expedition, and Lieut. Filchner had promises of a further $15 000 It was hoped, he said, that they would be able to send out two vessels in order to save time

Lieut Filchner is an explorer of experience He was one of the first to reach Lhassa, Tibet, and in 1903 and 1905 he explored Turkestan and Persia

The Life of Radium.

An interesting and informative popular lecture upon the wonders of radium was recently delivered before the members of the Authors' Club in London by Sir William Ramsay, K C B In describing the wonders of this element the eminent chemist confined himself mainly to a description of his own investigations and experiments In dealing with the Alpha particles he explained that these were really gas, and quite two-thirds of the energy of radium was transferred to the gas which it emitted, which comes off at a regular rate, and this he pointed out raised the question as to how long radium would last He replied for ever, as the amount of gas was always proportionate to the amount of radium present He likened this emission of gas to taking a slice of bread and cutting it in two which operation say occupied a minute, and then cutting one-half in two again, and so on continually cutting in two each successive half obtained How long would it take him to cut the bread entirely up? He could never do it. He would always be halving to infinity and the task would take him an eternity to perform. It was exactly the same with radium The amount of gas was always proportionate to the mass of radium existing and was always being produced There was however, he remarked, one point easily defined When would radium be half gone? They had just measured it in his (Sir William's) laboratory and had found that it would take 1,750 years so that anyone who invested in radium would retain at least one-half of the capital at the end of 1,750 years The Austrian government some time ago intrusted him with about half a gramme or one fifty fifth part of an ounce of radium for his private use Its value was about $45,000 Less than a year ago Dr Gray and himself performed the experiment of isolating the Alpha emanation of radium, and they inclosed it in a fine glass tube, much finer than the finest thermometer tube that was ever made They compressed it and liquefied it. In the latter stage it shone with a purplish light, although it was quite transparent like water When reduced to a temperature of —60 deg Cent it solidified and then it shone with an extremely brilliant light like a miniature electric arc light. The quantity they used was extremely small, being less than the point of the finest needle, yet they ascertained its boiling point, its melting point, and its specific gravity

Radium was the most concentrated form of energy known It is a substance which goes on changing into other things to which various names have been given These substances were named radium A, radium B, radium C and so on up to radium F Some had a very brief existence lasting only thirty or forty minutes, and he had never seen them He had seen radium D which would be gone in about forty years. This was a substance rather dull looking like lead and that was nearly all he could say about it There were other substances probably like polonium which Madame Curie discovered During these emanations radium gave a great deal of energy generally manifested as light but as a matter of fact radium kept itself hot, there was a great deal of heat generated It could be calculated, and it was found that it gave off about 3,500,000 times as much heat as would be given off by the oxyhydrogen blowpipe, which gave a temperature of over 2 000 deg Cent.

What did this energy do? It sent out the Alpha rays at a velocity of about 40 000 miles per second, and these particles naturally carried a great deal of energy The Beta rays, although only about one thousandth part of the size also carried tremendous energy owing to their enormous velocity, which exceeded that of the Alpha rays They could decompose water and metallic substances, and in these decompositions they found elements produced which they did not imagine to exist in the substances so treated For instance in decomposing ordinary copper sulphate they were surprised to discover lithium in what remained, and no traces of the copper salt He had repeated this experiment five times, and the experiments were still going on

Ephemeris of Halley's Comet

1910.	R A h m s	Declination ° ′	Log r	Log. Δ
April 4	0 5 18	+ 8 1	9.8100	0.2144
April 8	0 1 41	7 58	9.8101	0.1919
April 12	23 57 58	7 53	9.7881	0.1617
April 16	54 24	7 49	9.7718	0.1257
April 20	51 44	7 46	9.7688	0.0868
April 24	50 20	7 47	9.7737	0.0272
April 28	50 37	7 58	9.7911	9.9600
May 2	23 54 32	8 18	9.8140	9.8708
May 6	0 3 6	9 5	9.8103	9.7770
May 10	21 35	10 30	9.8654	9.6487
May 11	29 15	11 2		9.6049
May 12	38 12	11 41		9.5600
May 13	0 50 12	12 20	9.8877	9.5134
May 14	1 5 47	13 27		9.4618
May 15	1 24 47	14 36		9.4066
May 16	1 49 52	15 59		9.3501
May 17	2 23 1	17 20	9.9170	9.2945
May 18	3 7 19	18 51		9.2388
May 19	4 3 11	19 43		9.1993
May 20	5 3 23	19 8		9.1873
May 21	6 0 54	17 40	9.9468	9.1993
May 22	7 3 4	15 14		9.2388
May 23	7 44 48	12 40		9.2921
May 24	8 18 20	10 24		9.3480
May 25	40 7	8 31	9.9751	9.4049
May 26	8 58 52	6 59		9.4601
May 27	9 13 8	5 45		9.5120
May 28	24 30	4 45		9.5583
May 29	33 48	3 50	0.0049	9.6037
May 30	9 41 23	+ 3 15		9.6405

Astronomische Nachrichten, No 4370 A C D Crommelin

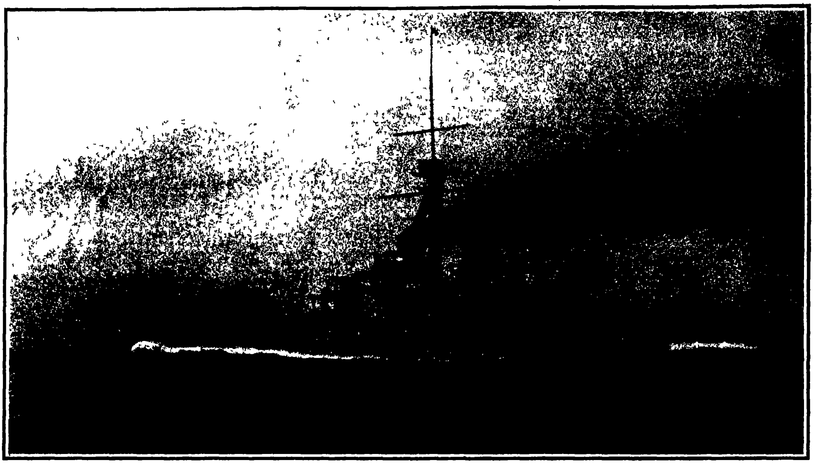
Prizes for Small Aeroplanes.

The practical utilization of the aeroplane is the object toward which the efforts of all constructors and experimenters are directed In furtherance of the same object, the French National Aerial League offers two prizes for small and easily managed aeroplanes One prize, offered by M René Arnoux through the agency of the League, will be awarded to the first aviator who shall succeed in starting from a selected road, bordered with trees and in landing on the same road after making a continuous flight of one kilometer (⅝ mile) or more The other prize, of 1,000 francs (about $200) will be awarded to the owner of the smallest aeroplane which shall make a continuous circuit of one kilometer The size of the aeroplane will be estimated by multiplying together the three maximum dimensions of the machine The competition will close July 16th 1910 A complete copy of the rules governing the competition can be obtained by addressing La Ligue Nationale Aérienne 27 Rue de Rome, Paris

The number of bacteria contained in milk increases very rapidly from the moment of milking for a certain time, and then slowly decreases Some bacteriologists have attributed this phenomenon to a bactericidal power possessed by the milk due to some unidentified ingredient Experiments have been made to isolate this hypothetical substance which appears to remain active up to a temperature of 140 deg F The milk was filtered through a porcelain cylinder, and the filtrate obtained showed greater germicidal power than ordinary milk, but no conclusive results were obtained The real explanation of the germicidal power of milk is much simpler The acidity of milk continually increases with age and thus milk continually becomes a less favorable medium for the growth of bacteria The bacteria also have to contend with the lactic ferments which develop very rapidly in sour milk and are generally victorious in the struggle for existence It is for this reason that the lactic ferments are employed in therapeutics

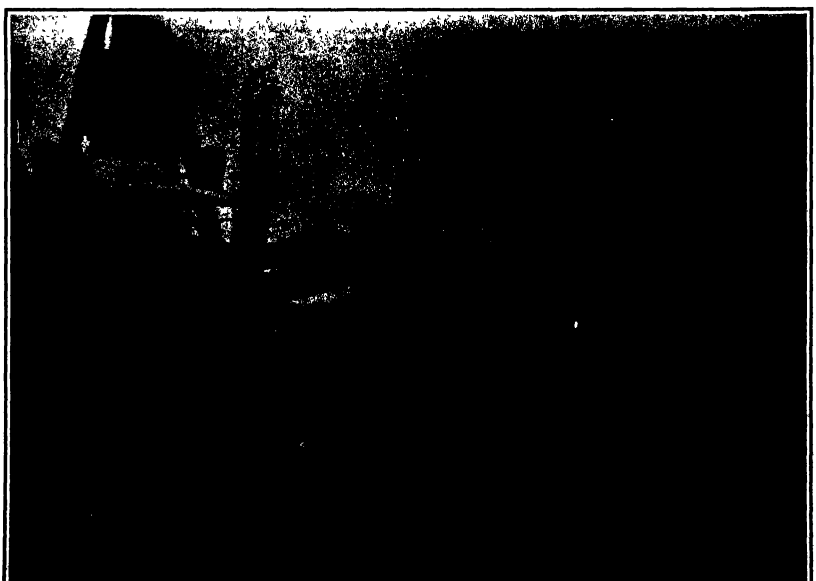
THE BRAZILIAN BATTLESHIP "MINAS GERAES"

In the early part of this year the first of the dreadnought battleships the Minas Geraes' about which much speculation has been rife, was handed over by the builders, Sir W G Armstrong, Whitworth & Co of Elswick, Newcastle-on Tyne, to the Brazilian government thus definitely disposing of the supposition that the vessel was designed for some other power This vessel has been the source of considerable discussion, since it represents the last word in heavy battleship design, and is at present the most powerfully armed warship afloat. Through the courtesy of Admiral Maurity, the president of the Brazilian naval commission in England, appointed by the government of the South American state to supervise construction,



Length, 543 feet. **Breadth,** 83 feet. **Normal displacement,** light, 19,000 tons. **Horse-power,** 27,212. **Speed,** 21 4 knots. **Armor:** Belt, 9-inch, extending for full height of hull, turrets, 9-inch; two protective decks, 1¼ inch and 2 inch **Armament:** Twelve 45-caliber 12-inch twenty two 4 7 inch Four torpedo tubes.

THE BRAZILIAN DREADNOUGHT "MINAS GERAES."



During the gun trials of the "Minas Geraes" ten 12-inch guns were trained on the broadside and discharged simultaneously. The combined energy of the projectiles amounted to 500,000 foot-tons, or sufficient to lift the ship bodily 26 feet into the air.

THE GREATEST BROADSIDE EVER FIRED FROM A BATTLESHIP.

we are enabled to publish the accompanying photographs and to give the leading particulars regarding this, the latest dreadnought.

The general appearance of the vessel may be gathered from the accompanying illustration The overall length is 543 feet, molded breadth 83 feet, molded depth 42.25 feet, displacement 19,000 tons, speed 21 knots. The propelling machinery, built by Vickers Sons & Maxim, who have the second vessel of the series completing at Barrow, is of the reciprocating four-cylinder triple-expansion type, driving twin three-bladed propellers. The cylinders have a diameter of 39 inches for the high-pressure, 63 inches for the intermediate, and 73 inches for the low-pressure, with a common stroke of 42 inches, and on the forced draft trial at 280 pounds pressure developed 27,212 indicated horse-power, giving a speed of 21 4 knots.

The outstanding feature of the vessel, however, is the armament. The main armor on the broadside amidships is 9 inches for a depth of 22 3 feet, 5 feet of which extends below the normal load water line. The forward and aft barbettes are protected by a transverse 9-inch armor bulkhead, while forward and aft the hull is protected by 6-inch belt armoring tapering to 4 inches at the extreme ends There are two protective decks, the upper being 1.25 inches thick, and the water-line deck 2 inches thick Nine-inch armor is also used for the upper strake amidships, and the 4 7 inch guns of the secondary armament are mounted within the citadel thus formed In regard to offensive armament, the main battery comprises twelve 12-inch 45-caliber guns Four are carried in pairs in two turrets in the center line of the ship, both forward and aft, the remaining two pairs being mounted on either side amidships. In order to permit these to be trained throughout a full arc of 180 degrees, the super structure is cut away fore and aft. It will be readily seen that the upper deck of the vessel is left clear of all obstruction, a factor which is one of the outstanding features of the design It will be seen also that the pairs of guns forward, as well as those aft, are stepped, the uppermost pair being some 12 feet above the level of those below, so as to enable the upper to fire over the lower pair It will be seen from this arrangement that a terrific gun fire can be concentrated on either side, for the forward and aft two pairs of guns can be trained through an arc of 180 degrees on either side of the center line of the ship, thus giving a fire from either broadside, including the pair of guns amidships of ten 12-inch guns Moreover, owing to a pair of guns fore and aft being set at a higher elevation, they have a corresponding advantage in action As these guns fire a projectile weighing 850 pounds, this means that an aggregate discharge of 8,500 pounds can be concentrated from either broadside In the accompanying photograph taken during the gun trials a full broadside fire is shown, and this is interesting as it is the first occasion on which ten 12-inch guns have been fired from a broadside. Similarly owing to the amidship guns on either broadside being capable of training through an arc of 180 degrees, it is possible to fire eight 12-inch guns ahead or astern.

The secondary armament comprises 4 7-inch guns and 3 pounders of the quick-firing type. The central superstructure of the vessel has been so designed as to carry four 4.7-inch weapons arranged in pairs one above the other on either side of the bridge at the forward end, with a similar disposition aft. These guns fire forward and aft, parallel with the center line of the ship, but have a considerable angle of fire abaft the beam. Also six 3-pounders are similarly mounted forward and aft in the same superstructure, while two other 3-pounders are carried on the top of each of the gun houses of the upper level pair of guns. On the main deck there are seven 4 7-inch guns mounted within the citadel of 9-inch armor on either side, and the arrangement is such that the guns can be trained through an arc of 50 degrees on either side of the center line transverse to the keel, so that they can be trained astern and ahead Altogether there are twenty-two 4 7-inch guns included in the secondary armament The result is that in action the vessel can pour a broad side from ten 12-inch guns firing 850-pound shells, eleven 4 7-inch guns firing 45-pound shells, and six guns firing 3 pounder projectiles. As all are of the latest quick firing type, a comprehensive idea of the formidable character of the attack of this vessel may be obtained

The gun-operating mechanism is electrically and hydraulically driven, electricity being used for training the turrets In addition there is emergency gear for every operation Immediately the gun is fired an air blast cleans it and the rammer is fitted with a water spray, so that in the event of any sparks remaining when the breech is opened they may be at once extinguished The accommodation for the personnel is most adequate and commodious, especially in regard to the officers' accommodation, and in view of the hot climate in which the vessel is to be in service, special attention has been devoted to ventilation. The navigating bridge has outer wings, which are also removed when the ship is cleared for action

The gunnery trials created unusual interest, and the representatives of several powers were present thereat The trials served to dissipate conclusively many apprehensions that had formerly been entertained For instance, there was considerable discussion as to what effect would be produced upon the gun crew in the lower barbette of the fore and aft 12-inch guns when the weapons immediately above were discharged In the first test the crew were withdrawn from the lower gun house when the upper pair was fired. It was found, however, that the roof of the lower house offered a complete protection against the blast, and that the crew could safely stay in the lower house without experiencing the slightest ill effects of the tremendous blast some five feet above their heads It was also considered that the principle of setting the fore and aft guns one above the other and at a distance of 36 feet center to center was objectionable, on the plea that the aiming of the upper guns would be interfered with by the flash from the guns just below, but here again practical trials dispersed any such objections These results, by the way, corroborate certain results obtained some years ago by our own Navy Department at Indian Head, when this system of mounting, first proposed and adopted in our "Michigan" and "South Carolina," was tested.

Cement for Aquaria – Equal parts flowers of sulphur, pulverized sal ammoniac and iron filings, mixed with good linseed oil varnish and adding enough white lead to make a solid, easily workable mass.

THE FIRST METAL BRIDGE IN AFGHANISTAN

The accompanying illustration represents the Diroontah suspension bridge, the first metal bridge to be erected in Afghanistan, which was opened last year The structure spans the Kabul River at the mouth of the famous Diroontah Gorge about seven miles from Jallabad Prior to the erection of the bridge communication was maintained between India and the adjacent country by means of a primitive native ferryboat, or raft, composed of skins stretched taut on a framework of rough timbers, and lashed together by means of crude native-made rope A cable was stretched across the river, and when the latter was at its normal stage the raft was pulled from one bank to the other by this means When, however, the waterway was in flood, and the turbulence and velocity of the current prevented recourse to the rope, the raft had to be rowed across the river, an operation which required considerable dexterity with the primitive oars used The journey was somewhat dangerous under the circumstances and the opposite bank was only gained some considerable distance downstream Owing to the rude character of the ferryboat a capsize was by no means infrequent, and indeed several lives were lost from this cause every year

When it was decided to erect a bridge, the site chosen for the structure was just off the old Kabul road As the photograph shows, the gorge is extremely wild at this point, the rocky cliffs dropping straight down into the water. The contract was carried out under Mr J R Halliday by the Calcutta engineering firm of Messrs. Burn and Company, Limited

The bridge has a span of 396 feet between tower centers, with a clear width between parapets of 10 feet. It is designed for pedestrian and light vehicular traffic. The inaccessible character of the site combined with the fact that none but unskilled native labor was available, rendered the task somewhat difficult The abutments had to be blasted out of the solid rock, as did the roadway approaches on either side On the Jallabad side these preparations together with the setting of the foundation bolts were completed in seven and a half weeks Work then had to be suspended for seven months, as the services of the Afghan labor was required in Kabul Upon resuming operations, work was continued without further intermission and the bridge was erected in the actual working time of five months Considering the nature of the work, and that the native laborers were quite unacquainted with the tools used such a performance was highly creditable A further month however was occupied in blasting out a roadway and approach to the bridge in the cliff face on the Lagna side of the river The bridge was opened by His Majesty the Amir of Afghanistan amid much ceremony and before a huge crowd of natives, who lined the precipitous hillsides to witness the novel spectacle

This graceful structure, recently completed, takes the place of a primitive rope ferry.

THE FIRST METAL BRIDGE TO BE ERECTED IN AFGHANISTAN.

Until a few years ago, all public coal lands were valued uniformly at a rate of $20 or $10 an acre, according if they lie less or more than 15 miles from a railroad Since July 1906, the government has been appraising its coal land according to the value of its contained coal The present value fixed for the government coal land, based on the new regulation, is $149,772,443, the value fixed for these same coal lands before the new classification was adopted was $48 240,971 According to these figures, it is evident, therefore, that if these lands had been sold at the prices prevailing before July, 1906, they would have brought the government about $100,000,000 less than their value at the prices now fixed

BIRDS AS MECHANISMS

By B. S. Bowdish.

The casual observer knows the birds as he knows the tree, the stone or the sea shell—an incidental object of passing interest, one of the trivial details in his every-day life. The novice bird student knows the birds, few or many species, by the clothes they wear, so to speak. If somewhat adept, he may even recognize birds by flight and song. Even the more profound ornithologist classifies birds by external character—largely bill, feet, length of wing and tail, number of feathers in each, etc. He is of necessity a specialist, paying particular attention to classification, pterography or the study of plumage, ornithological osteology, or some one of the sub-divisions of the general study of birds. Few individuals among any of the classes of students mentioned sufficiently appreciate the bird as a mechanism designed to play a certain part, every member like every detail of some complicated and perfect machine contributing toward perfecting the whole for its requirements.

Considering the bird from this standpoint and analyzing the parts with a view to their functions it seems natural to commence with the bill because it is the anterior extremity and because of the importance of its uses. This one feature of a bird's mechanism merits treatment in an article especially devoted to it and has, in fact, received such treatment.* It can be briefly reviewed only here. The bill not only performs the functions of a mouth in birds, but also serves as a hand. Having none at all on the posterior limbs, and only unsatisfactory substitutes on the anterior ones, birds must needs use the bill largely in lieu of a hand, and do so to a very considerable degree.

As has been shown, the bill largely conforms in shape to the requirements of the more important functions that it must perform, and exhibits a very wide range of variety in size and shape. It is used for cutting, tearing, and chewing food of various sorts, and for seizing, spearing, or engulfing prey. It is also used to dress the plumage, and by some species, such as parrots, to assist in climbing.

Birds' skulls, having a less diverse range of functions than the bills, show a correspondingly smaller degree of differentiation, but they do vary to some extent according to the habits and particularly according to the orders. In the lower types, such as grebes and loons, and most of the sea birds, the brain cavity is relatively small, but proportionately larger in the higher types, such as the thrushes, including the robin.

The vertebral portion of the skeleton plainly indicates the bird's descent from ancestral stock common with that of reptiles. Modern birds being no longer provided with reptile-like tails, as was the case with the earliest types (the archeapteryx had twenty caudal vertebræ, the bony structure of a long lizard like tail, each vertebra supporting a long feather on either side) the number of caudal vertebræ has become reduced to usually nine and these are short and with little apparent function, other than to support the feathers of the tail, fan like, about the outer bone.

The bony structure of the wings is an adaptation of the bones of fore limbs to the requirements of flight. In evolutionary history this adaptation was principally accomplished in the lizard like progenitors of birds and the modifications since then are not remarkable. The main arm bone, the humerus, and the secondary ones, the ulna and radius, are not very different from the corresponding bones in mammals. In the hand, however, the first and fifth fingers have disappeared, the index and third digits are small and scarcely functional, while the middle finger is greatly developed and furnishes the real bony support for the tip of the wing.

Wings for the great majority of birds are solely organs of flight, in a few species such as the ostrich they are rudimentary and functionless, serving at best only to preserve symmetry. In such species as penguins, however, while useless for flight, they are valuable as flippers or paddles, assisting progress through the water. In a very few cases they are used to assist the bird in climbing, usually largely while immature, as in the hoatzin of South America.

Next to the bills and wings the feet of birds are perhaps of the greatest functional importance. Feet and legs vary greatly, according to the usage for which they are designed. In the ostrich, which most nearly resembles in its mode of life some wild horse, the development of feet and legs is strikingly like that of the feet and legs of such animals. Birds like the kingfisher and humming bird, whose feet are used solely for perching, have absurdly underdeveloped, small, and weak looking feet and legs. In the birds of prey the feet are practically grappling hooks, designed to secure the firmest hold of the victims, the legs are heavy and strong. Birds like the herons, the storks, and cranes, who spend much time wading, have very long legs and long, slender toes, which, spreading over a wider surface, give a support analogous to that afforded by snowshoes. This feature is more strikingly illustrated in birds like the rails, that travel about on the yielding aquatic growth, and finds its highest development in the jacanas, tropical and sub-tropical birds of the rail family. Woodpeckers, creepers, and nuthatches, birds that cling a great deal to perpendicular surfaces, have very sharp claws and feet adapted to such requirements. Birds that swim a great deal have the feet webbed with a membrane extending between the toes, making very efficient paddles.

The flesh of birds is no less efficiently designed and disposed toward the fulfilling of the requirements of the birds than the skeletal structure. The more important muscles are peculiarly designed to render the greatest efficiency. The powerful muscles that operate the wings have their anchorage on the keel of the breastbone, and the latter is particularly deeply developed in birds of most powerful flight. This is true alike of the man-of-war bird, with its immense wing area to maintain spread for hours in sailing, and of the humming bird with its relatively small wings, driven at lightning speed to keep the bird poised before a flower.

In all of the passerine or perching birds, the muscle and tendon arrangement of feet and legs is such that the weight of the body resting on and contracting the legs draws the muscle over the main joint, and draws up on the ends of the toes, locking their grip on the perch. The same principle drives the talons of the hawks and owls into their prey.

Tongues in birds are also highly functional. In woodpeckers they are practically barbed spears, and the extreme protrusion that they are subject to is provided for by roots that extend around the back of the head and close up to the eye-sockets. In the humming bird the tongue is a pump for obtaining the nectar from flowers. In some species it is brush like, to facilitate handling the food, and in certain fish-eating species the upper surface of the tongue is covered with points inclined backward, to facilitate swallowing the slippery prey.

The eyes of owls, designed to see at night, are wonderful structures. Only a small portion of the entire eye-ball is visible. Each socket occupies nearly a third of the total skull space. The visible eye-ball is mounted on a thin bone frame, somewhat resembling a lamp-shade in shape, a structure differing radically from the type of bird's eye.

The feathery covering of birds is especially adapted to their requirements. It is light, offering the least weight to be carried in flight, and a poor conductor of heat and cold, affording the bird the best protection in the sudden temperature changes to which it is subjected. In birds like the penguins it is more like the hair of seals than normal feathers and is thoroughly waterproof. The feathers of ducks and water fowl generally are also practically waterproof. The power of flight is quite dependent on the feathers both of wings and tail which in action are spread to give the greatest supporting area for the air pressure to act upon.

As a complete mechanism, so perfectly do all its parts contribute to an absolutely smooth-working whole, in the bird, that the very wonder of this intricate machine passes unnoticed as a common-place incident.

1. The bird's paddle, 2, the oyster catcher's bill, 3, black skimmer's bill, 4, bony structure of bird's foot, 5 and 6, bill and foot of Cooper's hawk, 7, vestiaria related to honeysuckles, 8, mamo's bill, 9, heron's bill; 10, the osprey's foot, 11, cormorant's bill, 12, huia (male) related to starlings, 13, huia (female), 14, egret's bill, 15 and 16, bill of drongo, related to shrikes, 17, bones of a bird's wing, 18, foot of a barnyard fowl; 19, foot and leg of rhea, South American ostrich

THE BIRD AS A MECHANISM

* "Bird Bills" by B. S. Bowdish, American Homes and Gardens, July [illegible], vol. III, No. 1, pp. 85-87

Metal filament lamps generally are supposed to be of a pretty frail nature, so that the slightest touch breaks them. This idea is counteracted by an account given in the Electrical World of a collision between a Pennsylvania eastbound passenger train and an empty engine just outside Jersey City on the morning of November 8th. This accident resulted in comparatively few injuries to the passengers, due to the fact that the strong frames of the passenger cars resisted crushing. The damage to engines and cars, however, was considerable. One of the steel passenger coaches jumped the track and turned over on its side, denting in the steel plates about 18 inches. Included in the lighting equipment of this car were nine tungsten lamps, and it is interesting to note that, after the wreck these lamps were found to be in perfect condition.

EXPERIMENTS IN CRYSTALLIZATION

BY A. J. JARMAN

The making of crystals of various kinds outside a chemical works or chemical laboratory is not often practised, because it is commonly considered that the subject is a very difficult one or that it requires a complete knowledge of chemistry Such however, is a mistaken idea from either standpoint Crystals of extraordinary beauty both in geometrical form and brilliancy of color can be produced by any person determined to make the undertaking successful

The accompanying illustration shows a group of pyramidal crystalline structures that have been formed in the national colors

The red is made of bichromate of potash, the white of common alum, and the blue of sulphate of copper

Many salts can be employed that are very cheap, and after the crystals have been formed the solution left over can often be used The geometrical forms of the crystals can be observed during their formation, and it is interesting to watch how they grow as the liquid deposits the excess of salt When finished, they can be dried and preserved under a glass covering like wax flowers so as to preserve them for ornament and for educational purposes

To produce results as illustrated make a pyramid out of three pieces of wood five inches long, and a quarter of an inch square Wind each stick with cotton twine from end to end Bind these three strips well at the apex of the pyramid and then for the base make a little triangle of the same sized strips each piece being two and a half inches long Cement these firmly at the corners with sealing wax, then cover every part neatly with a winding of cotton twine Now distend the free ends of the three longer pieces, and fasten them to the base with sealing wax after which carefully cover all the waxed parts with twine For a fine pyramidal block of white transparent crystals prepare a small quantity of concentrated alum solution made by adding powdered alum to a pint of boiling water until no more will dissolve Dip the cotton twine covered tripod or pyramid into this solution, let it soak for a minute, then stand it in a plate to cool When cold it will be coated all over with very fine crystals of alum This is the starting point to build up the final crystallization Examine the minute crystals with a magnifying glass, when it will be seen that the face of each crystal is triangular in form the corners being cut off No matter how small or how large the crystal may be, it always assumes the same geometrical form, for every salt crystallizes in a form according to its nature

Procure a two-gallon stoneware crock and a one-gallon glass battery jar The battery jar should be eight inches high and six inches in diameter Pour seven pints of boiling water into the stoneware crock Add thereto about five pounds of powdered alum, a few ounces at a time stirring the solution well with a clear strip of glass As soon as the hot water will dissolve no more alum it is then saturated and must be poured into the glass battery jar, which has been previously warmed, straining the solution of alum by tying a three-fold piece of cheese-cloth over the top of the jar Now place in the battery jar a circular-like lid about ½ inch deep, such as the lid of a paste jar Set upon this lid a piece of glass four and a half inches square and upon the glass the slightly crystallized pyramid completely immersed in the solution and weighted down with a large alum crystal or a heavy glass stopper A small crystal of alum may also be placed upon the top of the pyramid All must now be left to cool gradually Under no condition must the vessel be disturbed, because this would cause the alum to be thrown down in a few minutes in very fine crystals like common salt

At the end of twenty-four hours, the whole of the pyramid will be covered with beautifully formed crystals. At the end of forty-eight hours, the pyramid may be removed, and the alum solution made hot once more, adding more ground alum to saturate the solution; pour this solution again into the battery jar and insert the pyramid with the sheet glass base, allow this to stand for a week, when it will be found to have become a mass of beautiful crystals, clustering into one solid mass. The pyramid must now be removed (the glass plate also by a slight tap) a pint of clean, cold water poured over it, then stood upon folded blotting paper to drain changing the blotting paper twice daily for a week to nine days, when it will be found that the crystals will become almost transparent The pyramid being complete it may now be covered with a suitable glass dome and it will form a unique and instructive ornament Several sets should be made from various salts, in various colors All of them can be carried out in precisely the same manner as described for alum

The following salts are not expensive and will give the various colors stated They will not become moist upon exposure to the atmosphere For white common alum and cane sugar, red potassium bichromate, yellow, yellow prussiate of potash, dark green, double sulphate of nickel and ammonia light green chlorate of nickel

There are very many other salts that will give a

RED, WHITE, AND BLUE PYRAMIDAL CLUSTERS OF CRYSTALS.

great variety of colors the majority of them being deliquescent becoming moist and melting upon exposure to the atmosphere but those enumerated here will be permanent under all ordinary conditions

SIMPLE METHOD OF PRODUCING THE ZEEMAN EFFECT

BY W. K. CARR

The world was startled when a few years ago, Prof Zeeman announced that if pieces of sodium were burned between the poles of a powerful electro-magnet the spectroscope would show the D line much broadened while the existing current was turned on, and that the original aspect of the line would be restored as soon as the current ceased

The experiment confirmed the much-discussed theory of H A Lorentz who assumed that the hitherto homogeneous and indestructible atom of the chemist was as a matter of fact heterogeneous and composed of minute particles or vortices in the ether of space, having a definite mass and possessing all the properties of negative electricity These particles, or vortices, which are now called "electrons" he conceived as vibrating about the common center of gravity of the atom and further that light was due to transverse vibrations in the ether generated by these rapidly moving electrons If argued Lorentz, the atom be made up of such particles or vortices, their rate of vibration would be altered by the lines of force in a magnetic field and we should be able to predict their behavior with accuracy Going back to two swinging pendulums for analogy, he pointed out that any motion to which the electron is subject could be resolved into three components one in straight lines parallel to the lines of magnetic force, and the other two at right angles to them, but since these last two can be further resolved into two circular motions (one to the right and one to the left) around an axis parallel to the lines of force, we can say that the motion which the electrons are capable of making may be divided into component number 1 in which the electrons are moving parallel to the lines of force, component number 2, in which they move with the hands of the clock, and component number 3, in which they move against the hands of the clock. Now suppose we look at the vapor of sodium in a magnetic field and along the lines of force Consider the electrons as negatively charged, and the lines of force runnin oward you what will happen? You cannot see any effect of component number 1, since the electrons o that component are moving in the line of your vision and since electrons emit waves only at right angles to the line of sight, hence to see the waves of component number 1, you would have to move your position and look at the burning sodium at right angles to the lines of force But with components numbers 2 and 3 the conditions are very different Here the electrons are revolving in circular orbits and in a plane at right angles to the line of sight, and since those which move with the hands of a watch are retarded, and those against the hands of a watch are accelerated the single line seen in the spectroscope would split into two, or as in Prof Zeeman's case, where the spectroscope was of small dispersive power only a broadening of line would be observed This then, was the experiment which startled the scientific world, startled it because one of the fundamental principles of science was apparently overthrown—the homogeneity of the atom of the chemist

Notwithstanding its value and significance, the experiment is rarely witnessed because of the ponderous and costly apparatus necessary to produce the division of the spectral lines Powerful gratings and magnets both exceedingly expensive have up to the present time been used in the demonstration The writer however has a very simple piece of apparatus costing less than $30 which shows the phenomenon admirably No claim to originality is made save in the matter of its arrangement which is so simple as to be well within the grasp of any intelligent boy Instead of the powerful spectroscope the reader will observe in the accompanying photograph a little interferometer attached to the telescope This is a modification of Fabry's and for it the writer is indebted to the inventive genius and the exquisite mechanical ingenuity of Prof Pfund of Johns Hopkins University And instead of the huge magnet used by Zeeman one weighing less than forty pounds is found more than ample The photograph shows a piece of board six inches long to which is attached *A* a lens of three inches focus, *B* a Nicol prism which can be revolved in its brass collar *C* the interferometer *D* the telescope and *O* a spring clip for holding the quarter wave plate This apparatus is simplicity itself is always in adjustment and can be rapidly shifted to view the phenomenon along the line of sight and at right angles to it

Instead of burning sodium let us use a tube containing helium gas, and place the apparatus so that we may view the light parallel to the lines of force and through the hole drilled in the pole piece of the magnet as seen in Fig 1 Examine the glowing tube before the magnet is energized and you will see several concentric yellow rings in the field of the telescope

Fix your attention upon any one of the rings which is the equivalent of the yellow line that would be seen in an ordinary spectroscope Turn the current into the magnet, and instantly the yellow ring splits into two Revolve the Nicol but you cannot extinguish the rings because just as Lorentz predicted they are circularly polarized Now introduce a quarter wave plate the effect of which is to produce a retardation of one-half wave length The light is now plane polarized and can be extinguished by the Nicol—a further and a beautiful confirmation of Lorentz's theory So much for components numbers 2 and 3 but component number 1 can not be seen since its electrons are moving parallel to the lines of force Now take out the Nicol and move the apparatus so as to view the light at right angles to the lines of force (Fig 2) Turn on the current and one yellow ring is observed to break up into three Let us analyze them bearing in mind what Lorentz said viz That one of these lines component number 1 was polarized lying in a horizontal plane, and that the other two, components numbers 2 and 3, were polarized in a vertical plane vertical because in this position we are looking at the edges of these circular vibrations, and the effect upon us is as if the particles were actually moving vertically Now introduce the Nicol with its short diagonal vertical, two rings appear, and with the short diagonal horizontal one ring appears a beautiful confirmation of one of the cleverest pieces of reasoning ever credited to the mind of man

In the whole realm of physics there is nothing more

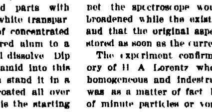


Fig. 1.—Looking in the direction of the magnetic lines.

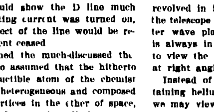


Fig 2.—Looking at right angles to the magnetic lines

APPARATUS FOR PRODUCING THE ZEEMAN EFFECT

striking, more significant, and the effect which it is destined to exercise upon the future of science is simply incalculable

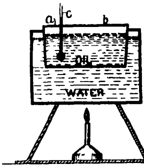
SOME SIMPLE TESTS FOR OILS.

BY RALPH F CLARKSON

There are several tests which anyone can apply without the use of special apparatus, and tell something about the grade of lubricating oil he is getting

THE FLASH TEST

Place a small amount of the oil to be tested in a



APPARATUS FOR DETERMINING THE FLASHING POINT OF OIL.

pan as indicated at *a* in the accompanying engraving, and heat by means of the lamp beneath As the oil heats apply a match at *b* After a time a flash is seen when the match is applied, but it disappears as rapidly as it came This shows that enough vapor had been produced to mix with the air and form an explosive mixture The temperature, given by thermometer *c*, at which this occurs, is called the flashing point. At some higher temperature if a match is applied, the oil takes fire This latter temperature is known as the burning point, and may be a considerable number of degrees above the flashing point.

TO DETECT THE PRESENCE OF AN ACID.

Dissolve a small amount of sodium carbonate in an equal volume of water Place it, together with the oil to be tested, in a flask or beaker and shake thoroughly The quantity of precipitate will be a gage of the amount of acid present.

TO DETECT THE PRESENCE OF GRIT

Drop a small amount of the oil on white or very light-colored blotting paper The oil will be absorbed, and the grit will be visible as small black specks on the blotter

TO FIND THE TEMPERATURE AT WHICH THE OIL CONGEALS

Put 15 parts of Glauber salts into a beaker Place in this a bottle containing a sample of the oil. Place over the salt a mixture of 5 parts hydrochloric acid and 5 parts of cold water The temperature is reduced slowly, and can be observed from time to time as the oil thickens Any freezing mixture or even ice can be used in place of the above

THE IONIZATION OF AIR.

SOME SIMPLE EXPERIMENTS

The terms ions and electrons have now become familiar in the explanation of electrical phenomena Most of the investigations upon which they are based however have been made *in vacuo*, and consequently they are but little understood, except by those scientists who have devoted their energies to their especial study There are however many simple experiments, mostly due to Righi, which can be made in air at the ordinary pressure, and which form a useful introduction to the study of ionization The accompanying illustrations represent some of these typical simple experiments performed by Mr C J Watson of Birmingham, which aroused considerable interest at a recent scientific *conversazione* in that city, and through his courtesy we are able to explain how they were carried out and how they may be repeated by any interested reader

It is well known that if a pointed wire be connected to one pole of an influence electric machine, and the other pole is earthed, a discharge of electricity will be obtained The proof of electric discharge may be easily verified by means of a lighted candle and a gold-leaf electroscope If the former is placed on the cap of the latter, the electroscope, even if disposed several yards from the machine, will collect continuously the electricity discharged from the machine Similarly, if the action is carried out in the dark, a small stream of purple light may be seen, which although scarcely visible, will exercise a pronouncedly marked influence upon an exposed photographic plate Another method in which this discharge may be ascertained is to place a condenser, comprising a piece of glass 1/16 inch thick coated on both sides with tinfoil to within ½ inch of its edge, opposite the point of the wire Then connect the two opposite coatings of tinfoil with a strip of the same material, which has a fine cut in it When the reverse side of the condenser is connected to earth, there will be a distinct spark jumping across the narrow gap

If this discharge point then be immersed in a metal box fitted with an opening which is covered with perforated zinc, so that the electrified air is forced through the perforations, if the box is earthed it will be found that the air which is thus expelled is totally deprived of electric charge It thus appears that the

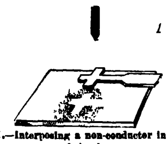


Fig. 1.—Interposing a non-conductor in the path of the ions.

electric charge is not carried by the particles of air generally, but by a smaller number of what for the present are generally described as ions.

Several simple experiments may be carried out to ascertain the paths pursued by these ions For instance, take a sheet of ebonite the reverse side of which is coated with tinfoil and earthed, and place it a foot distant from the discharge point. It is advisable to pass the sheet over a gas flame for a few seconds before each experiment, so that any electricity present in the sheet may be eliminated When the discharge from the electric machine is carried out for about one second, the sheet will be charged sufficiently No visible effect of this occurrence will be observable; but if the sheet is sprinkled with a mixture of powdered red lead and sulphur, and the same experiment is repeated with an obstacle of non-conducting material interposed between the discharge point and the sheet, such as say a cross, an image of that object will be produced upon the plate. If negative electricity has been discharged from the electrical point, then the sulphur will collect on those parts

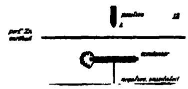


Fig 12.—Forcing a discharge through a zinc sieve.

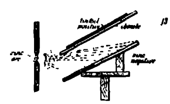


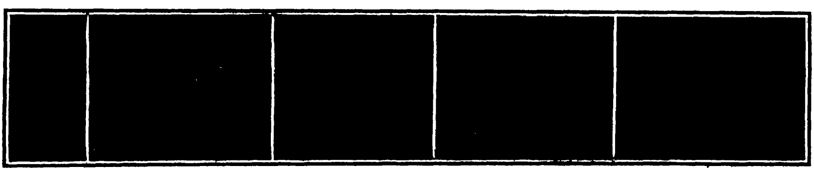
Fig 13.—Effect of ultra-violet rays on zinc.

immediately beneath the object, while the red lead will adhere to those parts charged negatively by the unimpeded discharge on the surrounding areas The drawing, Fig 1, shows how the experiment is carried out, while the photograph, Fig 2, gives the result of the interposition of the cross in the path pursued by the ions

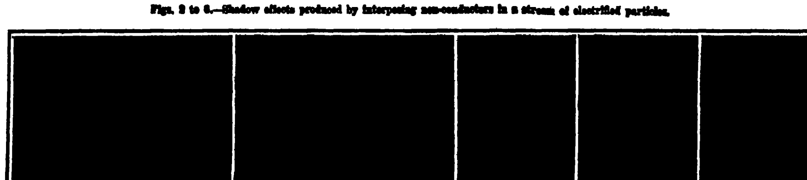
The image of the object is usually enlarged, but this factor is influenced to some extent by the length of time of the electric discharge A preferable method is to take a sheet of celluloid, as shown in Fig 3, perforated with holes at regular distances Then when the image of these holes is obtained, as shown in Fig 4, the distances between their centers can be measured When the distance of the ebonite sheet is varied (the distance of the celluloid sheet from the electric pole being kept constant) it will be found that the size of the image grows with the distance, but not proportionately The electrified particles or ions travel along the lines of electric force, and consequently generally in curved lines This has been proved by using, in stead of a point, a long thin wire held parallel to the interposed sheet of celluloid when the lines of force are circular arcs passing through the wire, and striking the ebonite perpendicularly to its surface

It will also be found that the streams of ions mutually repel each other, so that if the electrified point be very near to the celluloid, the individual images of the holes will be found to have enlarged themselves at the expense of the intervening spaces and will even be observed to have assumed almost a square form, as shown in Fig 5 This is of course analogous to what is observed with the cathode rays of highly exhausted tubes. A similar repulsion is also manifested when an insulated metal object is used as the interposed object This is illustrated in Fig 6 which represents the effect produced by a piece of brass tubing on the end of an ebonite rod, both being of the same diameter

(Continued on page 250)



Figs. 2 to 6.—Shadow effects produced by interposing non-conductors in a stream of electrified particles.



Figs. 7 to 11.—The effect of an air blast on the discharge, and of forcing a discharge through perforated zinc.

THE IONIZATION OF AIR.—SOME SIMPLE EXPERIMENTS.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

TELEPHONE-MUFFLER.—W D. Plumb, New York, N. Y The invention relates especially to a device the purpose of which is to increase the distinctness of sound produced by the receiver, the operation of the device consisting in muffling or dampening the sounds which may be produced sympathetically or otherwise in the diaphragm of the transmitter

PLUG FOR ELECTRICAL CONNECTIONS.—A N Dodd, Mount Vernon, N Y The improvement has reference to plugs for electrical connections, the inventor's more particular purpose being to provide a construction suitable for plugs of large size and used in connection with powerful currents such as characterize automobile charging, theater dimmers, and the like

Of Interest to Farmers.

MACHINE FOR COLD-ROLLING DISKS—A L Dow, Grover Colo. The aim of this invention is to provide a device which is of light weight so that it may be carried about from place to place It is so constructed that it can be carried into the field and readily attached to an engine used to reciprocate a plow, to drive the same It relates to machines adapted to sharpen and roll disks used in plows, disk harrows, seeders, drills, etc

HAY FORK —E. Swan, Elko, Nev The invention relates to a hay fork of the grapple type, which is adapted to lift a large amount of hay, to unload the same from a wagon, and which is also adapted to readily deposit the said hay on a mow or stack It is quick and positive in action, and strong and durable

Of General Interest.

APPARATUS FOR PRINTING WOOD GRAINING AND THE LIKE—J E Currens and W J Wesley, Erie, Pa More particularly the invention pertains to a device adapted to be moved over a surface and print or produce thereon the semblance of wood graining The main object is to so construct the apparatus that it may be used in producing a graining or printing on any stationary wall irrespective of its shape or position

STERILIZER AND WATER HEATER —A. R Talbott, Ellis, Kan In this case the invention refers to sterilizers and water heaters especially designed for dentists use, and the object is to provide in convenient form and at little cost, a device which will thoroughly sterilize instruments with boiling water, and will at the same time, heat water for cleasing the mouth

VIOLIN SUPPORTER —H A Smith, Danbury, Conn The purpose of the inventor is to provide features of construction for a violin support, which are convenient in service afford perfect freedom in handling the instrument, permit the quick easy connection of the violin with the supporting device and its release therefrom as may be desired

BOAT FLOORING —F Schmidt, New York, N Y For the purposes of this invention, a cushioned flooring is placed on a support in the vessel in such a manner that it is completely out of contact with the hull or other part of the vessel, so that the vibrations are absorbed by the cushion, and hence are not felt by the persons standing or seated on chairs set on the flooring.

Hardware and Tools.

RAZOR STROP —A L. Silberstein New York, N Y The strop is more especially designed for use in stropping thin razor blades, of the Gillette and other types, without much exertion on the part of the operator For this purpose the rocker of the strop is adapted to receive a removable blade holder having retaining means for holding the razor blade in position It relates to safety razor strops such as shown and described in Letters Patent of the U S , formerly granted to Mr Silberstein.

TOOL-HOLDER FOR PNEUMATIC HAMMERS.—V R. Lane, Berwick, Pa The most particular purpose here is to provide a construction adapted to the hammer, allowing the tool all necessary freedom and effectively preventing the tool from being unexpectedly ejected from the hammer so as to cause an accident

Note.—Copies of any of these patents will be furnished by Munn & Co for ten cents each Please state the name of the patentee title of the invention, and date of this paper

Legal Notices

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AND EACH BEARING THAT DATE

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NEW AEROPLANES.

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weight of the machine complete is about 400 pounds The thrust obtained from the propeller at 1,200 revolutions is in the neighborhood of 200 pounds. The double surface horizontal rudder is carried upon hollow inclined poles some 12 feet in advance of the main surface, and the single surface tail is similarly carried at the rear The machine is mounted upon a central runner having two smaller skids at each side There is also a skid at each end of the lower plane

The novel features of this machine are the foot control of the horizontal rudder, and the system of triangular vertical fins on the top of the upper plane for the purpose of maintaining the transverse stability automatically The aviator sits upon a small seat located in front of the lower plane and clings to two inclined braces running out in front to vertical struts connecting the poles that hold the horizontal rudder These inclined braces can be readily seen in the photograph as well as the pedals for the feet of the aviator which operate the horizontal rudder The vertical rudder is worked by a small lever held in the aviator's right hand, and the spark and throttle control of the motor is also conveniently placed

The theory upon which the transverse fins (each of which has about 2 square feet of surface) operate in order to maintain the transverse stability of the machine, is as follows When the machine tips to one side it has a tendency to slide down toward the ground endwise, but as the weight is placed very low and as the fins offer resistance to this side motion the upper part of the machine is retarded, while the lower part swings over like a pendulum, and the machine regains an even keel

In the first test the surfaces (which are of special paraffin-coated silk) were very loose owing to fog and dampness, and once the machine was in the air it was necessary for the aviator to sit well over to the left side, in order to counterbalance a difference in lifting power of the two sides of the machine The biplane rose readily after a run of about 85 feet The machine is said to have lifted at a speed of about 22 miles per hour The horizontal rudder was turned too far and the machine shot up to a height of 40 feet at an angle of nearly 30 degrees Mr Herring attempted to make a turn after flying some 300 feet, and the machine turned successfully tipping inward at an angle of about 20 degrees from the horizontal and making a 40 degree turn He then cut off the spark and descended In alighting the seat was split and a runner and one of the inclined rods were broken According to the inventor, the machine rose in the air with the aviator (who weighs 190 pounds) with a thrust of 140 pounds, and he believes that a thrust of 80 to 85 pounds is sufficient to fly it The throttle was not fully opened, and the motor, he thinks developed not more than 9 horse power when the machine was in flight

This biplane is the first aeroplane to fly in New England but it is principally noteworthy because of the new method of automatic stability which apparently seems to work fairly well

Mr Herring has replaced the vertical partitions of the Voisin biplane (which connect the main planes at the ends and at various points in between) by the six small triangular fins shown If these small fins, placed above the upper plane, answer the purpose as well as do the partitions in the Voisin machine, one can readily see that they offer much less resistance and skin friction to the air, and should make a much faster machine They form a means of automatic stability which is a decided improvement over warping wings or movable wing tips

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AMERICAN HOMES AND GARDENS

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CAPT. BALDWIN'S BIPLANE.

One of our illustrations shows the new biplane of Capt. T. A. Baldwin, the dean of practical American aeronauts. This new biplane has a number of original features, chief of which is the method of preserving the transverse stability by means of a single vertical stability rudder placed above the upper plane. This rudder is turned about its vertical axis by means of a fork fitting around the aviator's shoulders, as in the Curtiss machine. When the aeroplane tips to one side or the other, by leaning to the high side the aviator sets the stabilizing rudder at an angle to the line of advance. This exerts sufficient force to bring the machine back to a level keel. The new stabilizing rudder is the outcome of experiments tried several years ago by the Aerial Experiment Association. It has been tried out by Mr. Curtiss, who claims that it worked satisfactorily upon his machine.

The new biplane has a spread of 28 feet by a fore-and-aft width of planes of 5 feet, which makes an area of 280 square feet of the main planes. In addition to these there is a small biplane tail carried on a triangular frame extending back from the main planes and mounted upon a light skid. The vertical rudder is placed in the center of this tail which forms in reality the horizontal rudder, since the two surfaces are moveable and are used to direct the machine up or down.

The arrangement of the power plant and aviator's seat is just the opposite of the usual arrangement, and is along monoplane lines. The motor is at the front edge of the lower plane and the aviator's seat above the rear edge. The fly wheel of the motor extends below and above the plane. The propeller is placed half way between the upper and lower planes and is driven by chain from the motor. It is a large, high pitch propeller of between 8 and 9 feet diameter.

The aeroplane is mounted upon two pneumatic-tired wheels in front and a single skid at the rear. The regular Curtiss single-wheel control of the rudders is fitted. The machine has had several successful tests upon the frozen surface of Lake Keuka, at Hammondsport, N. Y.

THE BLERIOT 1910 MODEL MONOPLANE.

The latest model Bleriot monoplane known as the "No. 11 *bis*" is shown from the rear in one of our illustrations on page 236. As can be seen at a glance the body of the machine is now completely covered, while a new form of tail resembling that of the Antoinette monoplane has been fitted. The horizontal rudder is in two parts hinged at the rear edge of the tail proper. The spread of this new model is 7.2 meters (23.6 feet), the wings being about 11 x 7 feet in size and having an area of 12 square meters (129.6 square feet). The length of the body has been reduced from 7 to 6.6 meters (21.64 feet). The total weight is 310 kilogrammes (682.0 pounds), or with aviator 832 pounds. This means a lift of 6.46 pounds per square foot of the deeply curved surfaces. The highest lift per square foot heretofore obtained has been 5 pounds, so M. Bleriot has apparently improved his machine in this direction although he has not diminished its weight but instead has increased it in order to give it greater strength. The same 3-cylinder, fan shaped Anzani 25 horse-power air-cooled motor is used as heretofore. This motor develops its power at 1,400 revolutions per minute, at which speed it revolves the 6.82 foot Chauvière propeller. The pitch of the propeller is nearly half its diameter and the thrust obtained about 200 pounds. This new model is operated the same as his previous machines by a universally jointed control column pushed forward or pulled backward to direct the machine down or up, while it is moved sideways to warp the wings and correct the transverse equilibrium.

SIR HIRAM MAXIM'S AEROPLANE.

BY R. P. HEARNE.

Authentic details are now available

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concerning the aeroplane which Sir Hiram Maxim has built at Crayford, Kent England No small degree of secrecy has been maintained, but to those who are acquainted with Sir Hiram's theories, it was evident that he would base the present aeroplane on the main principles which governed the design of the remarkable machine which he built and tested at Baldwyn's Park in 1894

The present machine is the outcome of his original researches and of plans developed during the last five or six years but not until 1908 was the veteran inventor able to devote himself fully to the planning of a new flying machine He also set himself designing a gasoline motor, as he held the idea that much of the trouble with the present aeroplanes was due to the unsuitable engines employed Sir Hiram has now evolved a flying machine in which every portion from engine to propellers has been constructed according to his own ideas. His first care was to reduce the proportions of the machine as compared with those of the gigantic apparatus which he constructed at Baldwyn's Park The total width of the new aeroplane is 44 feet, while his earlier multiplane had a span of over 100 feet

Like its prototype, the new aeroplane is of the multiplane type, and is in effect made up of six aeroplanes, each being 6 feet 6 inches in width, fore and aft The planes are notably thin, and are neatly covered with waterproof silk fabric very tightly laced From the central plane spring out two superposed wings, raised well above it, and so curved as to produce automatic lateral stability to a very high degree There are balanced rudders fore and aft, and a horizontal steering rudder The Maxim patent device for varying the pitch of the planes when in flight is utilized This differs from the Wright warping device The wings are moved in one direction by a lever worked by hand, while a spring controls them in the reverse direction

The engine is mounted between the planes, and behind the pilot, who sits in a low metal-covered compartment with the steering and control wheel in front of him This disposition gives a very clear lookout, and at the same time the aviator is better protected from the wind A highly novel feature is the propelling gear On the engine shaft is one small screw propeller mounted at the rear of the planes This screw travels at the same rate as the engine shaft, and serves also as a flywheel There are two larger propellers each 11 feet in diameter, mounted higher up between the planes and driven by cables whose tension is controlled by jockey pulleys The small screw and one of the large ones rotate in the same direction, the other large one in the opposite direction This screw is also given a finer pitch and higher velocity than its companion, and in this way its gyroscopic action balances the joint gyroscopic action of the two propellers, which rotate in the reverse direction This arrangement of the screws is as ingenious as it is novel

In the engine, too, Sir Hiram has shown how closely he has studied every phase of the problem. He has selected a special brand of Vickers steel as the material for his 4-cylinder 60-horse power motor, and has been enabled to reduce weight while leaving a good margin of strength Special care has been given to the carburetor and the valves Sir Hiram claims that his engine works with far greater regularity and smoothness than the average aerial motor used on the Continent The engine is fully water cooled and the radiator is mount ed under the upper plane in a manner suggestive of that adopted by Santos Dumont on his little monoplane A most ingenious system of automatic forced feed lubrication is employed,

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which carries oil to every working part of the engine in a very effective manner. Indeed, the new motor promises to set a splendid example in aeroplane engineering, for it shows that, by skillful designing and the choice of suitable material, a light motor can be built with all the refinements which are now usually fitted to high-grade engines for motor-car work. The spasmodic action of many aeroplanes at present in use is due largely to the fact that their engines are unreliable.

The new Maxim aeroplane is mounted on wheels fitted with neat shock absorbers. Regarding the machine as a whole, its clean lines and uncommon aspect are the most striking features. There is a noteworthy absence of the complication of stays, guy wires and framework, which on many biplanes cause so much head resistance. The grouping of the various organs has been very skillfully done, and as far as possible those parts which set up most resistance are set in the same lines, one behind the other, thus minimizing wind resistance. In effect the whole machine bears evidence of remarkable originality, both in its general form and in its main details. Sir Hiram does not yet propose to test it in free flight, as he has built an apparatus like that designed by the late Capt. Ferber, whereby the machine can circle in a captive state around a steel mast. When so many other machines, however, are experimented with in free flight by aviators of small experience, the Maxim method may not seem altogether necessary, although with a striking new type of machine it is undoubtedly a very sure course of procedure.

THE OLIVE BRIDGE DAM

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cubic yards of rock excavation and 7,200,000 cubic yards of embankment and refilling. The plant of the contractor at the Olive Bridge dam consists of four cableways, about 95 feet in height, which extend across the valley above the dam with a clear span of 1,530 feet. The crushing plant, with a capacity of 200 tons of crushed stone per hour, and the concrete mixing plant are located conveniently to the work, the material being brought below the cableways, by which it is deposited as desired along the structure. Work was begun in the fall of 1907, and at the present time about 35 per cent of it has been completed.

The total length of the aqueduct (which is 17½ feet wide by 17 feet in height) from the Ashokan reservoir to the city line is 92½ miles, and its cost will be about $45,000,000. To render the work perfectly secure and permanent, wherever the aqueduct encounters streams or rivers of any magnitude it is carried beneath them either by deep pressure tunnels, or by steel and concrete pipes. The most notable pressure tunnel will be that below the Hudson River. In some respects this is the most interesting feature of the work, and we are informed by Mr. Alfred D. Flinn, Department Engineer of the Board of Water Supply, that the borings have revealed at great depth a granite rock eminently suited to carry this great and important conduit. In addition to a vertical boring made from a barge at the center of the river, which has reached a depth of 708 feet, two diagonal borings have been made one from either shore of the river. That from the eastern shore descends at an angle of 44 degrees for a distance of 1307 feet, where it has reached a point 70 feet from the center of the river. From the west shore, descending on an angle of 38 degrees, another boring has been driven for 1780 feet, which is now within 150 feet of the center of the river. The vertical shafts are now being sunk on either shore; they will be carried down to a depth of 1,200 feet below mean high-water level of the Hudson River at

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Wrench, G. Johnson 951,398
Yarns and fabrics in the special utilization of washed flax waste, manufacturing, Korselt & Thomas 951,261

A printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863 will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

(Concluded from page 249.)

this point. At that depth they will be connected by a horizontal tunnel. The aqueduct passes through the mountains, and reaches the westerly shore of the Hudson River at an elevation of 400 feet above tide level, and here vertical and horizontal shafts will connect with the 1,200-foot deep shaft at the immediate edge of the river, making a total depth of 1,600 feet from the flow line to the lowest level of the siphon. It is gratifying to realize that after the doubts and anxieties regarding the geological conditions affecting this work, its construction in solid granite has been assured. It should be mentioned that the whole siphon will be lined through out with concrete.

At Kensico there is being built an auxiliary storage reservoir of about 40 billion gallons ultimate capacity, of which about 20 billion gallons will be available at flow line level. The elevation of the discharge will be 355 feet above mean tide. At Scarsdale, 4 miles south of Kensico, will be a large filtration plant, and at Hillview, 6 miles to the south of this will be built another storage reservoir with a capacity of 930 million gallons, the discharge being 295 feet above tide level.

The Kensico dam, which will be built across the valley of the Bronx, will be a masonry structure 290 feet high and 1830 feet long.

From the Hillview reservoir water will be carried to the several boroughs of the city in a pressure tunnel excavated deep down in the rock beneath the boroughs of Bronx and Manhattan and under the Harlem and East Rivers, to a point in the heart of Brooklyn, where it will be brought to the surface and continued in metal pipes, one branch leading north to the borough of Queens, and the other passing below the Narrows to Richmond at a point where the width is about 10,000 feet. The construction of this tunnel will confer the inestimable advantage that even at the lower end of Manhattan the water will rise to a height of 260 feet above sea level, or say to about the top of a 20-story building.

The total cost of the work from and including Ashokan dam to the city line, all of which is now under contract, is $69,094,870, and of this amount work to the value of $10,000,000 has been completed. The total cost of the whole scheme when all the watersheds have been developed, will be $162,000,000.

IONIZATION OF AIR

(Continued from page 245.)

The metal becoming charged gives a greatly enlarged shadow.

The ions travel in a strong electric field at the rate of several thousand feet per second, and it is not the air which conveys the charge, although it is dragged along by the ions in the same manner as it is by a jet of water. This can be demonstrated very easily by directing a blast of air at right angles to the path of the ions. Scarcely any deflection of the latter occurs. For instance, in Fig. 7 is shown the image of an ebonite rod and a glass tube produced in the manner already described. The next illustration represents the same objects with a strong blast of air thrown athwart the course of the ions. The effect of the blast is only shown issuing from the tube just beneath the rod. Otherwise the result is exactly the same as if there were no blast.

The experiments may be varied within a very wide limit, and an interesting variation is to use, instead of the ebonite sheet, a plate of metal well insulated and connected to the other pole of the electrical machine, instead of earthing the pole as previously described. On the sheet of metal lay a piece of paper, and upon this sprinkle filings preferably a mixture of magnesium and black iron oxide. Between the sheet and the discharge pole, interpose an object as before, such as the cross, and when the

(Concluded on page 251.)

(Concluded from page 250)

electrical machine is set in action the filings will disappear from under the ebonite cross, giving a well-defined image, as shown in Fig 9

In the early part of this article it was pointed out that the electric discharge would not pass through perforated zinc under the circumstances there prevailing But it can be made to do so To bring about this result place a plate of metal connected to the second pole of the machine beneath the ebonite sheet in such a way as to bring it opposite the discharge point A in Fig 12 Sprinkle the surface of the ebonite sheet with the powdered red lead and sulphur, and interpose an earthed sheet of perforated zinc or a metallic sieve between the discharge point and the ebonite When the electrical machine is set in action a perfectly defined image of the perforations of the zinc obstacle will be obtained upon the ebonite sheet as shown in Fig 11 If the plate condenser with its connected sides of tinfoil, mentioned previously is used, the passage of the ions through the perforations may be ascertained by the sparks jumping across the narrow gap The explanation is that under the conditions described the electric field extends uninterruptedly from the point of discharge to the insulated metallic plate, so that the perforated sheet is in a perfectly neutral condition and scarcely intercepts the ions.

Several other striking and interesting methods of ionizing air can be carried out, such as by a flame white-hot metals, electric sparks, and so on One of the most impressive is that showing that ionization is produced by ultra violet rays falling upon zinc If a plate of clean zinc connected to a gold leaf electroscope be negatively electrified and illuminated by the light of burning magnesium, or better still by an electric arc between zinc electrodes it is rapidly discharged If the charge is positive, the phenomenon will not be produced. The experiment will also serve to show that these negative ions follow the definite paths of the lines of force The illustration, Fig 13 shows how to carry out this experiment The tinfoil backing of the ebonite plate is connected to the positive pole of the machine Opposite this plate and parallel therewith is placed a sheet of zinc, connected to the negative pole of the machine leaving a clear width of about three inches between the two plates. The zinc plate is illuminated by the ultra violet light from the zinc arc light for about a minute Under these circumstances the lines of force run perpendicularly between the two plates, and if any design is painted in varnish upon the zinc plate, the emission of ions from that portion of the zinc will be arrested and a reverse image of the design will be obtained on the ebonite plate when subsequently dusted with the powdered red lead and sulphur mixture

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The experiments of Sainte-Claire Deville and Caron apparently proved that the Oriental sapphire owes its beautiful color to the presence of a minute quantity of chromium in a state of oxidation lower than that which corresponds to the sesquioxide. It has not hitherto been found possible to reproduce the blue color with the aid of chromic oxide and reducing agents, nor yet to obtain by fusion in the oxyhydrogen flame, artificial sapphires colored by traces of oxide of iron If however, a small quantity of titanic acid is added together with the oxide of iron, the reduction of the acid to titanium oxide takes place to such an extent that the mass fuses and assumes the fine blue color of the sapphire This result has been obtained by Verneuil, who is of the opinion that in addition to sapphire colored by oxide of chromium there is an other variety which owes its color to oxides of iron and titanium We have seen specimens of these artificial sapphires and to us they seem as beautiful as those of nature.

SCIENTIFIC AMERICAN

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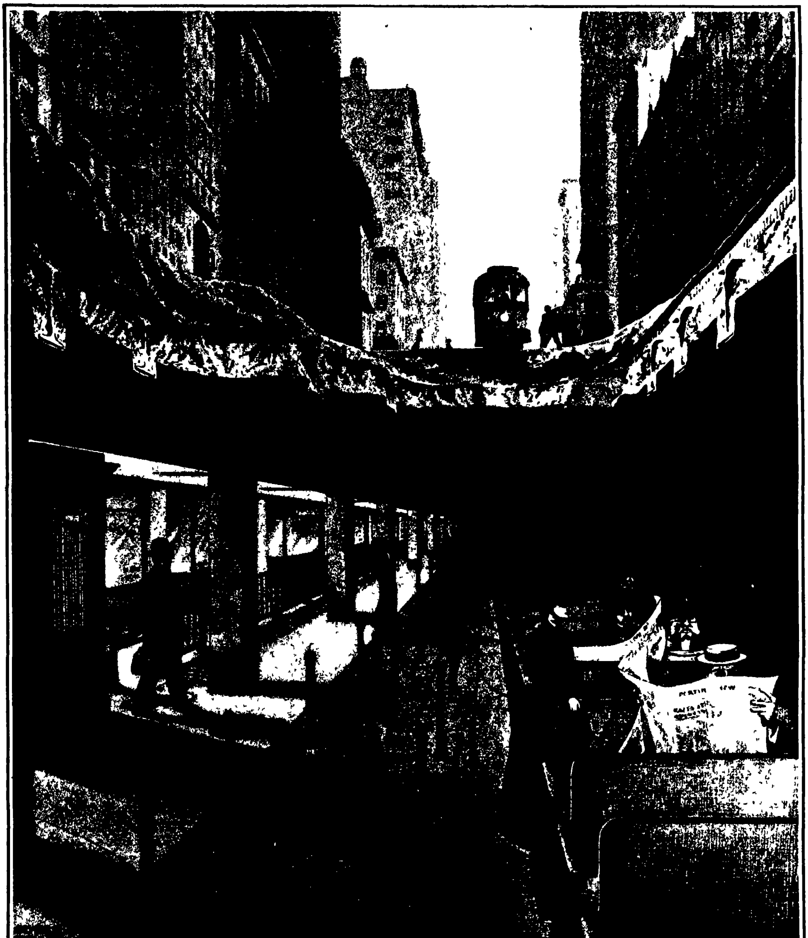

The method of transportation by moving platform shown above can carry, according to the Public Service Commission, 78,500 people per hour at 12 miles per hour. Up to distances of 4 miles this is as fast as travel by the present combined express and local service. The express trains can carry 36,000 and the local trains 22,500 per hour. The successive platforms move at 3, 6, 9, and 12 miles per hour.

RAPID TRANSIT BY BELT CONVEYOR.—[See page 257.]

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NEW YORK, SATURDAY, MARCH 26th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE PRESERVATION OF THE CITY HALL PARK.

IT is a positive misfortune that the lack of a co-ordinated plan, coupled with the astounding rapidity with which the city has been built up, to say nothing of a total want of foresight on the part of the municipal authorities, should have robbed the metropolis of the New World of the opportunity to present those aggregations of magnificent municipal buildings, grouped about spacious and carefully laid-out plazas and public squares, which are one of the glories of the great cities of the Old World. Such public spaces as we possess have been gradually encroached upon and their intended vistas have been closed and too often positively disfigured, by buildings of no architectural beauty which have been run up apparently without any appreciation and certainly with a total disregard of the architectural opportunities thus presented and so ruthlessly thrown away.

Perhaps the best known of our public squares is City Hall Park, which early in the last century, was beautified by the erection of that gem of municipal architecture, the City Hall, a building which even at this late day maintains its position unchallenged as the most perfect piece of work of its kind in New York, if not in the whole of the United States. For the greater part of a century this classic building was practically the sole occupant of the park, and, standing in the midst of its green lawns and surrounded though not obscured by an adequate growth of timber, this beautiful structure long remained as the dominating feature of what is certainly the most interesting and in some respects the most beautiful of our smaller city parks.

The first desecration of this spot occurred when the Federal government erected at the apex of the triangle that unsightly pile which for several decades has done duty as the General Post Office, a building which not only entirely shuts out the charming view of City Hall and the Park which was formerly obtainable from Broadway, but constitutes in itself a monument to the total lack of refinement which marked the public architecture of the day in which it was built.

And now it is proposed not only to further encroach upon the already restricted area of the park by building thereon a County Court House of colossal dimensions, but it is intended, if you please, to place this structure immediately behind the City Hall, whose just proportions and delicate beauty will be entirely dwarfed and ruined by the towering and widely overlapping façade of the building. Although it may be a palliation it is certainly not a justification of Mayor Gaynor and the other city officials who favor this course, to state that they do so unwillingly and after a sincere endeavor to secure some other suitable site. For there is a possible though very costly, escape from the dilemma by means of the alternative plan which originated with the architects of this city and is receiving the indorsement of the leading artistic municipal improvement, and historical societies, to say nothing of a thoroughly unanimous public press. This proposal is that the city purchase the two blocks lying immediately to the north of the City Hall and place the new Court House upon the land so secured, the various departments being housed in the large office and other buildings now covering this land until such time as the new Court House is ready for occupancy. As the needs of the city demand it and the funds become available the land so acquired would be covered with other municipal buildings of a monumental character, and ultimately this group of buildings, and the City Hall Park with the present historic structure would form an important center with landscape and architectural effects of dignity and beauty that would be commensurate with the importance of a city which is destined ultimately to become in size, wealth, and importance the leading city of the world.

In giving our hearty indorsement to this proposal, we are not unmindful of the fact that New York city has now in contemplation public works on an enormous scale involving the expenditure of vast sums of money. But we also realize that in municipal as in other affairs, conditions may occasionally arise in which sacrifice on the part of the present generation, large as it may appear at the time, may come to be regarded by posterity as but a small price to pay for the lasting benefits conferred.

The present crisis surely presents an opportunity of this very character.

THE MEYER NAVAL REORGANIZATION TO HAVE A FAIR TRIAL.

IN view of the diversity of opinion which was developed at the hearing of the House Naval Committee that body followed, we think, the wisest course in failing to recommend any legislative action until Secretary Meyer's plan has been in operation for a sufficient length of time to prove the extent of its practical utility. As to the wisdom of some of the changes which the Secretary has made, there can be no possible difference of opinion. The institution of a separate and independent Bureau of Accounting is one of the best reforms that have been introduced into the navy for many a decade, and already at the Boston yard, where it has been for a considerable time in operation, the system has shown very satisfactory results.

We are also heartily in sympathy with the proposal of the Secretary to dispose by sale of those of our older vessels, which are so deficient in certain necessary qualifications of a modern warship as to render the expenditure of a heavy sum of money upon them for repairs and reconstruction a very doubtful policy. A few years ago England struck off the list and put up at auction over one hundred of her warships, and there is no question that her navy was the better for this very drastic pruning out of dead and decayed material.

Although the proposal to separate the work of the navy yard under the broad division of hull and material is based upon logical grounds, and would ultimately prove to have working advantages of a practical character, we think that the proposal to so separate the work is somewhat premature and this for the reason that we have not to-day among the engineering corps, a body of men of sufficient shop experience to qualify them for that oversight of the shops which is contemplated in Secretary Meyer's plan. If the institution of a separate department of machinery includes as an indispensable corollary the training of a certain number of the naval engineers for *permanent shore duty* as managers of the steam engineering shops of the navy yard the success of the plan would seem more certain. In any case, we believe that until such a trained body is available it would be advisable to continue both the steam engineering and construction shops under the management of the naval constructors.

Now that the Meyer plan is assured of a lengthy period of trial the country may rest assured that the whole of the naval service affected by the changes will co-operate in a loyal endeavor to give the new plan such a perfectly fair trial as will serve to determine its practical utility. Therefore we greatly regret to see that a prominent New York daily paper has so far forgotten the dignity which attaches to its well deserved reputation, as to indulge in a bitter personal attack on certain naval officers who have recently testified before the House Naval Committee, and that our contemporary has gone so far as to insinuate that because some of these officers were not in sympathy with certain features of Mr. Meyer's plan the only proper course left for them to pursue was to tender their resignations.

It is unjust and misleading for that journal to omit to state that these officers had no choice in the matter of giving testimony before the House Naval Committee, when once they had been summoned before that body, and that it was the wish of the Secretary that they should reply to the questions of the committee unhampered by any consideration of whether their views were or were not in harmony with his own.

So far from their frank expressions of disagreement with certain phases of the Secretary's plan showing in any sense a spirit of insubordination, we rather take it to be evidence of a true moral courage which places the highest interests of the navy above any consideration of a purely personal character.

Therefore to insinuate as does the New York Sun, that from these and other gentlemen in the navy who may happen to disagree with certain parts of the Secretary's plan, it would be impossible to secure proper co-operation during the coming months of trial, is to betray a complete ignorance of that high professional spirit which pervades the United States Naval Service, and is nowhere more conspicuous than in that hard working and little appreciated body of officers, the Naval Constructors.

THE SCOTTISH SHIP CANAL.

THE British government having reviewed the various projects for a ship canal through Scotland, whereby the Forth and the Clyde can be connected, have decided that so far as naval requirements are concerned, the most favorable route is that through Lochs Lomond and Long, or as it is generally called, the "Low Level Route." Such a canal the government states would unquestionably possess some strategical value, and as they would financially assist such a scheme, the promoters of the enterprise are urged to push the matter forward in commercial interests. The government, however, stipulates that the canal shall have a floor width of 148 feet, a depth of water of 36 feet, and locks 850 feet long by 110 feet wide at the entrance, with a depth on the sill of 36 feet.

A sea level canal was found to be impossible, for although the mean level of the sea is practically the same on the Clyde and the Forth, the level at high water is not, so that a sea level canal would produce sharp tidal currents which would involve serious risks in navigation.

According to the designs which have already been prepared, the entrance to the canal from the North Sea would be a little distance north of Grangemouth, striking inland in a northwesterly direction, skirting Stirling on the south and running into the Forth valley which does not attain a higher elevation than 30 to 60 feet above sea level, then passing through the haunch of Ben Lomond into the valley of Endrick. This cut would be the heaviest on the whole route, the ridge attaining a maximum height of 260 feet above sea level. But it is short. Entering Loch Lomond, the waters of which are deep enough for the largest vessels afloat, the loch is followed for 13 miles to Tarbet, where another cut is made through the neck of land, 1¾ miles wide separating Loch Lomond from Loch Long. The latter would be entered at Arrochar and this loch, which has a very great depth of water, is followed until the Firth of Clyde is reached opposite the Cloch Lighthouse. The locks would be placed at either end of the canal that on the Clyde to lift the vessel to the level of the water in Loch Lomond which is 22 feet above the mean level of the sea and the other at Arrochar to regain the sea level in Loch Long.

The total length of such a canal would be 51 nautical miles of which 30 miles would be in canal and the other 21 miles in the open waters of Loch Lomond and Loch Long. The deepest cuts would be one of 191 feet near Stirling, another of 285 feet at the head of the Forth valley, and one of 142 feet between Tarbet and Arrochar. These cuts though deep are very short. The vessels will have to be lifted at the Forth end of the canal 13 feet at high water and 31 feet at low water, at Arrochar the lift would be 17 and 27 feet respectively. In addition a regulating lock would be formed at the head of the Endrick valley to be used when Loch Lomond is in high flood.

Further advantages of this route are the avoidance of river deviations, only comparatively small brooks being encountered, which could be easily syphoned across the canal. Only one deviation would be necessary, that of the Endrick, which after all is only a stream. Again, the minimum of interference with the railroads will be offered. No swing bridges will be necessary and it will be possible for vessels to proceed without shortening their masts. The sharpest curve will have a radius of two miles. The construction of the canal will entail the excavation of 170,000,000 cubic yards of material, and its cost, to meet the Admiralty requirements, would approximate $120,000,000. Work would occupy seven years.

Apart from its strategical value, the canal would have distinct attractions for commercial traffic. It will offer a shorter route between America and Europe, and will avoid the dangerous passage *via* the Pentland Firth. The extent of this "North About" traffic as it is called, including the coastal traffic, is considerable, and the saving of from 100 to 500 miles in the sea journey of the transatlantic vessels, according to the situation of the European port would be an important consideration. The aggregate of this traffic which would use the canal is 10,724,805 tons per annum, and at an average rate of 37½ cents per ton this would yield an annual revenue of about $4,021,800, which after deducting $300,000 as the annual cost of maintenance, etc., would yield about 3 per cent. on the capital for an Admiralty canal. The scheme is being actively pushed forward, and so soon as some idea of what the government would be prepared to do financially is obtained, no difficulty will be experienced in securing the necessary financial support to construct the waterway.

AERONAUTICS.

M. Ader, the Frenchman said to have flown about 1,000 feet in 1897 with his steam-propelled monoplane, the "Avion," has recently been decorated with the red ribbon of the Legion of Honor. His machine is said to have embodied the wing-warping principle since patented by the Wrights.

Proceedings have been begun in France to invalidate the Wright patent No. 342,188, of March 24, 1904, on the ground that the patent was not worked in France within three years, as must be done according to the statute. In searching for anticipations the French lawyers have discovered the English patent No. 392 of Mathew Watt Boulton, granted in 1868, which provides movable wing tips or "ailerons" for the purpose of transverse stability. In 1870 Richard Harte, another Englishman, took out a patent (No. 1469) for maintaining transverse stability by means of revolving wing tips operated by a weight.

The second annual combined aeronautic and motor boat show opened in Olympia, London (England) on March 11th. Besides numerous small models, forty to fifty aeroplanes and balloons were shown. In addition to the regular French models of Wright, Blériot, Farman and Santos Dumont, a number of British built duplicates were shown by well-known firms, as the Humber Company, for example. In addition to these there were a number of new aeroplanes built by English inventors. Interest in aviation is very strong in England at present, and several big aviation meets are planned for the coming summer.

In preparing for a re-hearing of his case on the 19th inst., Glenn Curtiss has experimented to see how much resistance can be interposed at the ends of the planes of his biplane without causing it to swerve. He used small vertical fins 1x2 feet in size, and found that these could be set at right angles to the line of flight for a few seconds without causing the aeroplane to swerve from a straight path and without moving the vertical rudder. As the resistance of the balancing planes which Curtiss uses is far less than is obtained in the manner just described, there can be no turning tendency produced by them, and hence no use of the vertical rudder in conjunction with them. Mr. Curtiss has also flown with the vertical rudder tied and with it loose, showing that a movement of this rudder is not required. We also learn that the Antoinette monoplane has been flown with the vertical rudder left off. With these practical demonstrations of flight without the use of the Wrights' patented combination, there seems to be little doubt that any infringement suits they may institute will be successfully defended.

On Saturday March 12th, Aviator Louis Paulhan made only a short straight-line flight of 500 to 600 feet at the Jamaica race track. The strong wind of 25 miles an hour velocity, and the few spectators were the principal reasons. On Sunday, however, several thousand people journeyed to the track, many of them in automobiles, and despite a wind nearly as strong as that of the day before they were not disappointed. About 4.45 P. M. Paulhan started against the wind, which was blowing directly across the track. His machine rose after a run of some 75 feet and traveled diagonally across the track while ascending constantly at an angle of 15 to 20 degrees. It rose to a height of 300 feet above the trees on the opposite side of the track, then, turning around, it sped back with the wind, passed over the grand stand and, making a sharp turn, swooped suddenly to earth at the very point at which it started 8 minutes before. Paulhan's was the most thrilling exhibition of flight ever seen near New York, and it is unfortunate that a dispute with his manager has stopped any further demonstrations.

On March 1st and 2nd Mr. Henry Farman made some record flights with passengers with a new biplane. His machine was originally built for the Rheims meeting last August, but it did not fly then owing to an accident. Despite its small size and surface, it showed excellent lifting power and stability. The spread of the upper plane is 34 feet, while the lower plane is 12 or 14 feet shorter, besides having a large section cut away in the center to accommodate the propeller. Movable flaps are fitted to the back edges of extensions of the upper plane only, and the tail consists of but a single horizontal surface between the two halves of the vertical rudder. The machine is mounted upon combined runners and skids and fitted with a 50 H. P. Gnome revolving cylinder motor. On the 1st inst. Mr. Farman made a flight of over 16 minutes with Mme. Franck and another passenger, thus beating his three-person record of 10:39 made at Betheny on August 28th, 1909. The following day he again flew with two passengers and remained aloft 62 minutes, or more than four times as long as the day before. On account of its reduced surface, Farman's biplane must have lifted over 3 pounds per square foot, which is a high figure for a biplane.

ELECTRICITY.

In September of last year the Boston and Maine Railroad established a telephone train dispatching system on the line between Boston and Fitchburg, Mass. This system proved so satisfactory that the railroad is now about to equip two new divisions with telephones. One of the divisions consists of a 95-mile line, from Concord to Woodsville, N. H., and the other of a 70-mile line, from Concord to White River Junction, Vt.

In a lecture before the Engineering Society at Birmingham, Sir Oliver Lodge discussed the question of protection from lightning. He stated that the problem consisted in finding the best method of dissipating the enormous energy of the flash, but that it was not wise to get rid of the energy too quickly. A thin iron wire is considered the best lightning conductor from the electrical point of view, but it is almost impossible to protect a building from lightning unless it is completely enveloped in a metal cage. It is by no means true that a building is safe when provided with a conductor reaching up to the tallest part of the building.

Experiments made with ultra-violet light appear to show that it is more effective for sterilizing liquids than ozone. The ultra-violet light is produced by means of mercury vapor lamps, quartz tubes being used instead of glass tubes, which are placed in direct contact with the water to be purified. A French investigator, M. Victor Henri, has found that the bactericidal action varies greatly with the distance of the lamp from the bacteria. With a Cooper Hewitt lamp of 110 volts an exposure of 300 seconds at a distance of 60 centimeters was required in order to kill the bacillus coli. At a distance of 40 centimeters an exposure of 180 seconds was sufficient, and at 20 centimeters 20 seconds. The temperature appeared to have little if any, effect, for the microbes were destroyed even when the liquid which contained them was frozen. In treating opaque liquids such as milk it was necessary to spread the liquid out in a thin layer. For milk the maximum thickness of layer with which the effect could be produced was one inch. Another investigator produces the ultra-violet light by means of electric discharges in a rarefied atmosphere of carbon monoxide, carbon dioxide, sulphureted hydrogen, or sulphurous acid.

An interesting description of the rural telephone lines in the Ozarks was published in a recent number of the Electrical Review and Western Electrician. Every farmer in this region, no matter how poor he is, has a telephone. The telephone lines have been installed by amateurs and every variety of telephone is used on them. Owing to fear of lightning the connection from the pole line to the house wire is made by bending the ends of the wires and hooking them together. When a thunder storm approaches this connection is unhooked and it frequently happens that the owner forgets to re-establish connection with the main line after the storm. The lines are all grounded, making it very difficult for one party to call another. Fifty telephones to a line is considered a light load. The lines are supported on such poles as can be easily obtained, which are seldom sunk to a sufficient depth in the ground to prevent them from leaning at all angles. Trees are also used to support the lines and the branches are seldom cut away to clear the wires. However the subscribers appear to be satisfied if only their line "talks." The subscribers usually combine to put up a switchboard in the nearest town and pay some one for attending to the calls.

A very interesting method of electroplating has been developed in England. The metal that is to be deposited is mixed in powdered form with other substances and it is merely necessary to wet the powder and rub it on the surface that is to be plated. The other ingredients are an electro-positive metal, such as zinc or magnesium, an inert substance such as chalk, and a salt which when wet serves as an electrolyte. The following description of the process is given by the author: "The electro-positive metal constitutes the anode and the object treated the cathode, and as 'Galvanit' contains a quantity of finely powdered electro-positive metal it makes innumerable contacts with the cathode surface and acts as so many minute anodes. These innumerable minute anodes gradually dissolve, and in dissolving set up in the liquid little local circulations of electric current. The circuits are so excessively small, so exceedingly near together, and so numerous that they cannot be separately observed, and the surface of the metal becomes the seat of innumerable concomitant voltaic and electrolytic actions. Thus the potential or stored-up energy of the elementary substances in the powder is converted into electric current, and as these currents leave the liquid they throw down from the metallic salt in solution a thick film on the cathode, and it becomes plated over with a deposit."

SCIENCE

Prof. Lowell announces that he has discovered a new canal a thousand miles in length on Mars. The canal developed between May and September last.

It is stated that many of the library newspapers, printed twenty years ago are disintegrating because our modern wood-pulp paper is not permanent.

The collection of Indian costumes, weapons and utensils brought together by E. W. Lenders of Philadelphia and valued at $30,000, has been bought by J. Pierpont Morgan and given to the American Museum of Natural History.

The astronomical clock at Hampton Court Palace has been removed for repair and repainting for the first time for nearly thirty years. The clock, which was the first of its kind in England, was made for Henry VIII in 1540. In 1880 it was brought from a shed at the palace, where it had lain for nearly half a century, and by order of the Office of Works was re-erected in the position which it has since occupied in the courtyard of the palace.

The comet discovered by Daniel in December is not the same as one discovered in 1867, for which a period of about forty-two years had been found. Daniel's comet has been found to belong to the Jupiter family of comets having a period of about six and a half years. There are now over thirty of these, and four or five of them pass through perihelion every year, but they are in many cases so faint as to elude observation altogether.

W. W. Coblentz has discovered that one of the ingredients of the milky fluid which the firefly (*Photinus pyralis*) exudes when touched exhibits an intense blue fluorescence when it is exposed to ultra-violet rays. The fluorescence spectrum is very bright and continuous from 380$\mu\mu$ to 510$\mu\mu$. ($\mu\mu$, the unit in which wave lengths are measured, equals 1/1,000,000 millimeter or 1/25,000,000 inch.) The "phosphorescent" light which the firefly emits at night is orange-colored and its spectrum extends from 510$\mu\mu$ to 670$\mu\mu$. Hence the two spectra are mutually complementary.

In the northern part of Archangel, which is the most northerly government of European Russia, a farm for the breeding of Kamschatka otters, blue foxes, sables, martens, and other valuable fur-bearing animals is being established by German capitalists. The soil and climate of this district are exactly suited to the animals and the annual rental charge is only about 5 cents per acre, so that the venture appears very promising at first glance. On the other hand a large initial outlay is required. The farm contains 1,200 acres, is inclosed by a fence covered with sheet iron, which has cost $67,000, but the burrowing propensities of the foxes and rodents will probably make it necessary to extend this barrier underground, at a large additional expense.

F. Soddy finds that the growth of radium proceeds according to the square of the time. On the assumption that no other intermediate bodies intervene, the period of the direct parent of radium is 17,500 years. The amount of radium present in the last prepared solution is less than that to be expected; this suggests the existence of at least one new product, "Uranium A," intermediate between uranium X and the parent of radium, with a period of the order of one year. It is concluded that this would not appreciably alter the production of radium according to the square of the time over the period observations have been made, but it would vitiate the calculations of the period of the average life of the parent of radium according to the Rutherford formula.

A German bird fancier has made a series of experiments for the purpose of determining the vitality of eggs in different stages of incubation. On the fifth day of incubation five canary bird's eggs were taken from the nest, marked with numbers and replaced in the nest, one by one, at half-hour intervals. This experiment was repeated ten times with as many clutches of eggs. As a rule the first three eggs replaced hatched normally and the two others failed to hatch. Hence it may be inferred that the average longevity of a canary bird's eggs taken from the nest on the fifth day of incubation is 1½ hours. In the same way the longevity was found to increase to 2 or 2½ hours on the seventh day and 3½ to 4 hours on the ninth day of incubation. It was discovered by accident that eggs in a very advanced stage of incubation can endure very much longer periods of removal from the nest. Two eggs, purchased as plover's eggs, in the course of an excursion, were stowed in a basket, brought home and forgotten. On the evening of the following day a faint "peep" recalled the existence of the eggs and it was found that a young snipe had issued from one of them. The second snipe soon made its appearance, but lived only an hour. Hence it appears that the vitality of partly hatched eggs depends on the size of the bird as well as on the stage of incubation.

An Account of a Trip in the Largest Balloon Ever Constructed

A BALLOON TRIP OF FORTY YEARS AGO.

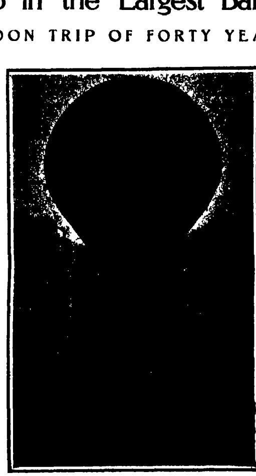
It is doubtful whether the sensation of traveling in an airship has ever been better described than was done forty nine years ago last June by Garrick Mallory and published in the Philadelphia Inquirer, June 30th 1860 after a voyage in the largest airship that had ever been constructed up to that time

Mr Mallory was a gentleman of education and fine descriptive talent and later commanded a brigade of cavalry during the civil war Prof T S C Lowe, the aeronaut in charge has a distinguished civil war record as an aerial scout He is constructing a great modern airship in his home city, Pasadena, Cal Here is Mallory's account, somewhat abbreviated

"The ascent of Mr Lowe's mammoth airship on Thursday last was by no means an ordinary occasion *Soi-disant* scientific aeronauts had in treatises and speeches positively demonstrated that it could not float Accordingly, when on the ground, we were beset with gratuitous advice from self constituted professors and atmospheric voyagers to the effect that it was madness to risk the untried experiment, and as to our friends we were ridiculed, threatened, cajoled, bribed, and wept over by turns

"So we held a council of war with ourselves in attempted cool reason and positively could not see why an increase of capacity in a balloon must necessarily diminish its efficiency, or that a greater range in the amount of gas to be evolved on the occasion, and in the number of sand bags to be retained or thrown away according to the object of ascent or descent, should destroy control over the element to be navigated

"The few uncut ropes are held by strong arms, the enterprising workman who seems to desire an ascent on the edge of the basket is induced to get down and put a bag of sand in his place, the other two gentlemen who determine at the eleventh hour to acquire aerial honors scramble in when the swaying has begun, the 'last dying speech and confession' has been made, all hands let go—and we are off! We don't believe it, however, in the slightest degree There is no motion perceptible, and we ourselves are entirely stationary Something to be sure is the matter with the field It has dropped Perhaps that is the reason why the crowd down below there is making such a noise They are frightened, most probably To be sure, they have some reason, for it is a rather alarming occurrence for the solid earth to fall down in that way, especially when all nature is so calm, and the sun shines so happily, and our car is so nice and fixed So we feel badly about our unfortunate fellow beings who are momentarily becoming smaller Suddenly a brilliant idea seizes us that we have actually begun the great ascent, and we forthwith begin to wave the flags and hurrah and jump No, we don't jump, for there isn't room, but we would if we could. The mites down below give cheer after cheer responsive, and run futilely in our course, and we fly away



LOWE'S DIRIGIBLE BALLOON.
After an old newspaper print.

"Although nothing could have been easier than to have risen immediately to a great height, yet as the lower breeze was northerly and light, we purposely remained in it, as thereby a deliberate view of the city and its environs was presented that could not be hoped for once in a thousand times. We had precisely the day, the hour, the current, and, above all, the balloon for a bird's eye inspection of Philadelphia, so sailed calmly on, silent, and ravished with ecstasy At the altitude of three thousand feet we look down fondly on Gray's Ferry, Darby, and the park, scenes of our equestrian pleasures, and then turn to the sparse houses of semi rural Moyamensing, picturesquely isleted in green lakes and foliage Next we glide on over the great city, seeming to lie asleep in that soft summer evening, with never a breath to disturb its happy rest, save the vague murmur of life which steals upward toward us, like the distant hum of invisible insects. We are higher now, and to the naked eye vast buildings like the Continental are distinguished chiefly by their known position, but as we pass along, the streets radiate on all sides with mathematical exactness, bordered with faint green lines of foliage. The public squares are patches of verdant enamel, and the spires point up at us with the beams of the sun shining from their whiteness until they only can be likened to the hoar-frost appearing on a window in winter Far away Girard College is discerned in the distance as an anthill of marble dust, and Fairmount is found in a fairy toadstool, with the Schuylkill curving close to it like a silver thread dropped, perhaps, from the robes of Titania herself But it is perfectly in vain to attempt any description of this most exquisite scene, which naught but the colors of the most gifted could pretend to convey to any who have not beheld it Indeed, it was all to us but a seeming picture seen in an enraptured vision There was no reality about it We were real, and the car, but every-

(*Continued on page 266*)

VERTICAL PHOTOGRAPHY

BY CHARLES MONROE MANSFIELD

In recording scientific material, whether plants or their fruits, or any peculiar material of which a record in picture is valuable, the exact size is always desirable Various apparatus have been constructed to support the camera and hold the subjects, but the real secret lies in the focus of the lens Any subject placed twice the focal length of the lens from the lens, and the lens twice its focal length from the focal plane, will give a picture natural in size For example, a nine-inch focus lens placed eighteen inches from the subject and the focal plane the same distance from the lens will give a natural size image in focus on the ground glass without further adjusting the camera

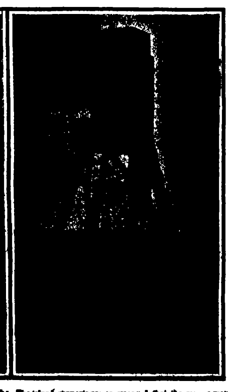
Nearly all actual size work is done vertically This gives the operator the privilege of manipulating his 'under ground during the exposure without interfering with the subject. The object to be photographed is usually placed on a glass support, which may be either plain or ground, and the back or under

(*Concluded on page 267*)

Just an ordinary camera and tilting tripod top. The legs of the tripod may be adjusted to give the camera the needed height. The glass may be supported by four corks or a wooden frame as shown in the photograph

The operator can revolve the entire outfit during the exposure. This gives uniform lighting and illuminates the shadows. This camera may be suspended from a tree.

This is a very simple stand for vertical photography. The camera may be moved up or down the groove in the stand and the glass frame can be regulated to any height by a worm screw on the back. This stand was made by a photographer at a very small cost.



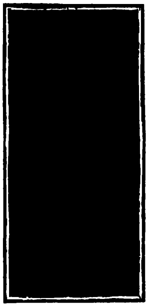
The tripod supports are so arranged that the camera may be set up vertically The ground glass object support is regulated by a thumb screw on the camera back and the bellows racked back and forth at the will of the operator. This is the same camera that is suspended from the ceiling.

VERTICAL PHOTOGRAPHY.

AN INTERNAL COMBUSTION WATER PUMP

THE INGENIOUS INVENTION OF H. A. HUMPHREY

Widespread interest has been aroused in European engineering circles in a new type of pump that has been evolved by a well-known English engineer, Mr H. A. Humphrey, M. Inst. C. E. It is based upon an entirely new principle, and is a revolutionary departure from existing practice, the novelty of the design compelling as much attention as its remarkable efficiency and economy



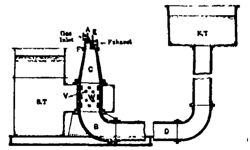
INTERNAL COMBUSTION WATER PUMP.

The pump is based on the fundamental principle of internal explosion, but does away with all the usual working parts of a gas engine, such as the piston, connecting rod, crankshaft, fly wheel, two-to-one gear cams and bearings There are no moving parts what ever except the simple mushroom valves, which open and close automatically, due to pressure changes, and the use of a flywheel is not necessary because a column of water, forming part of the water pumped, acts as a reciprocating flywheel. The water column, which also acts as a piston, has four unequal strokes, such as theory requires when expansion is carried to atmospheric pressure. These strokes comprise long strokes during combustion and expansion as well as during exhaust, a shorter stroke during suction, and a still shorter stroke during compression There is no valve across the discharge pipe at any point, so that the water has a perfectly free passage from the explosion chamber to the high level tank.

The explosive mixture of gas and air is ignited, as in the ordinary internal-combustion engine, and in contact with one end of a column of water which fulfills the dual function of piston and flywheel and moves so as to draw in a fresh combustible charge, to compress this charge previous to explosion, to permit expansion to be carried to atmospheric pressure, and finally to exhaust the products of combustion. All these movements are brought about and controlled by changes in the momentum, which occur naturally in the column of water itself

In order to explain the cycle of operations in a pump o the simplest type, a reference to the accompanying diagram will be found useful. The pump proper is built up from three main castings. There is the combustion chamber C, the water valve chamber W, and the bend B, which connects the pump to the discharge pipe D, leading to the elevated tank E T The suction tank S T is extended to embrace the valve-box chamber, as shown, so that there is free access of water to all the water valves V The last are plain mushroom valves, opening inward, and held on their seating by light springs In the top of the combustion chamber is an inlet valve A, as well as an exhaust valve E Arranged between these two valves is a simple interlocking device, so that when valve A has opened and closed it locks itself shut, and releases valve E, and when valve E has opened and closed it locks itself shut and releases valve A Consequently, each time suction occurs in the chamber these valves open in turn.

For the purpose of demonstration, suppose a gaseous charge is compressed in the top of the combustion chamber C, and is ignited in the usual manner by the sparking plug, which projects through the top casting or head of the combustion chamber All the valves are shut at the instant the charge is exploded, and



SECTIONAL VIEW OF INTERNAL COMBUSTION PUMP.

the increase in pressure resulting from the expanded gases forces the water downward in the pump, and sets the whole column of water in the bend B and discharge pipe D in motion The column of water attains kinetic energy while work is being done upon it by the expanding gases, so that when those gases finally expand to atmospheric pressure, the column of water may be moving, say, 6 feet per second The motion

(Continued on page 267)

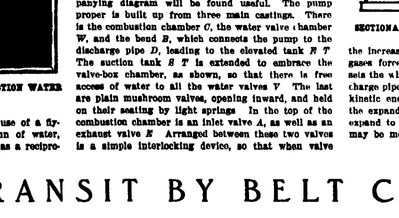
RAPID TRANSIT BY BELT CONVEYOR

A PROPOSED AMPLIFICATION OF NEW YORK'S SUBWAY

The method of rapid transit by means of continuously moving endless platforms has never as yet received the attention which its unquestionable advantages deserve, for, within certain limits of speed, it possesses a capacity for carrying passengers which is so far beyond that of any existing system as to place it in a class by itself That the system has not been put into practical application in the solution of those problems of congested city traffic for which it is so admirably adapted, can only be explained by the extreme novelty of the method employed, the inertia of that deep-rooted conservatism, which, even in this strictly utilitarian age, exerts such a powerful controlling influence on human affairs. The construction and operation of the moving passenger platform is so simple, and its great carrying capacity is so obvious, that its advantages are readily perceived even by the layman who may have no particular mechanical aptitude or training, and it is certainly significant that the proposal to equip a section of the proposed New York Subway with a moving platform has received the indorsement of such men as Henry B. Seaman, the Chief Engineer of the Public Service Commission, and of Mr. L. B. Stillwell, the electrical engineer who was responsible for the electrical equipment of the Elevated Railroads and the New York Subway system. Interest in the proposed moving platform has been recently revived by the recommendation of the Board of Estimate of this city that a moving platform be installed in a subway extending across Manhattan Island from the East to the Hudson River below Thirty-fourth Street, and on the front page of the present issue is a sectional illustration, which shows the general character of the construction both of the subway and of the moving platform itself.

In those branches of our industries, for the economical operation of which it is absolutely necessary that material be conveyed from place to place at a maximum speed and with a minimum cost, it has been found that there is no system of transportation which so perfectly fulfills these conditions as the belt conveyor Particularly is this true where a great bulk of material, consisting of more or less finely divided units, such as coal, iron ore, and wheat, have to be moved in great quantities with as little interruption as possible and without any manipulation by hand In this system, an endless belt moves continuously in a given direction, and facilities are provided for loading the material on the belt at any desired point and for unloading it therefrom at any desired point of delivery

The moving platform is nothing more nor less than a huge belt conveyor, in which the material to be conveyed consists of the teeming millions which constitute the passenger traffic of a great city, with provision for loading the passengers at any point throughout the length of the platform and unloading them while the latter is in motion The train consists of short jointed platforms, coupled together and forming an endless chain which is kept in continuous motion This platform is provided with transverse



View of the method of driving the platforms by means of stationary electric motors and differential rubber-tired wheels.

RAPID TRANSIT BY BELT CONVEYOR.

seats, and it travels at a continuous uniform speed of twelve miles per hour For transferring the passenger from the fixed station platforms to the seated platforms, there are introduced between them three narrow "loading platforms" which move at differential speeds. The first of these adjoining the station platform moves at three miles per hour, the next at six, and the next at nine miles per hour The passenger who wishes to board the train, faces the direction in which it is moving, steps onto the three-mile-per-hour platform, and, crossing the other two successively, takes his seat. The success of the escalator or moving stairway, of which many are now in operation throughout the country, removes any doubt of passengers being able after a little practice to accommodate themselves to the speed of three miles an hour involved in boarding the train

The advantages of the arrangement as summed up by the Chief Engineer of the Public Service Commission are as follows

1 A vastly increased capacity, and seats for all passengers.

2 There is no delay incurred by waiting for trains at stations, as the train is always there and constantly moving

3 Passengers may board or leave the train at any point at will, and instead of placing stations one-third of a mile apart, as on the present Subway, they may be placed at every cross street, or indeed at any intermediate point, and the construction may take the form of a continuous arcade

In its general construction the tunnel would be similar to those built for the ordinary Subway traffic It is proposed, however, to build arcades throughout its length, with store windows at basement level, and continuous promenades between them and the barrier separating them from the Subway platforms At each street crossing, and if it be desired at one or more points between them ticket booths and turnstiles will be installed —an arrangement which would permit passengers to board the cars practically at any desired point throughout the length of the subway

The arrangements for driving the platform by electrical power are as follows Extending longitudinally beneath each platform is a pair of I-beams, the upper flanges of which are riveted to the bottom of the platform, while the lower flanges serve to support the weight of the platform upon pairs of wheels, which are carried upon transverse shafts mounted at intervals of 2 feet 9 inches, upon concrete piers, as shown in the engraving Between each pair of longitudinal I beams is carried a pair of horizontal guide wheels which engage a guide rail that serves to keep the platform in proper alignment At every 75 feet, 10-horse-power motors are mounted on the floor of the subway, and are connected by a chain drive

(Concluded on page 268.)

CONDENSED FACTS ABOUT HALLEY'S COMET.

BY H. W. [illegible]

A few facts presented in a condensed form may possibly interest the readers of the SCIENTIFIC AMERICAN who wish to follow the course of Halley's comet in the heavens during its present appearance.

The last perihelion passage occurred on November 15th 1835. The present perihelion passage will occur on April 20th 1910. The perihelion distance will be 0.587, and the aphelion distance will be 35.30. The eccentricity is 0.967, the longitude of ascending node is 57 deg. 16 min., the node and apsis angle is 111 deg. 17 min., the inclination of the orbit is (162 deg. 12 min. +) 17 deg. 48 min. — the longitude of perihelion is 305 deg. + and the motion is retrograde, in other words opposite to that of the planet. The diameter of the nucleus cannot of course be stated with anything like accuracy at the present time, but it is not likely to exceed 120,000 miles.

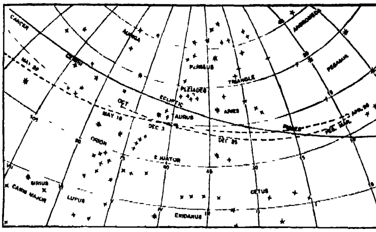
At the end of February Prof. Barnard of Yerkes Observatory estimated the tail to be 14,000,000 miles long. Just before and after perihelion passage the tail will be at least that long and probably longer. The comet is fast approaching its perihelion point, or point nearest the sun, where, as we have said, it is due to arrive on April 20th. During the months of February and March, the earth and the comet are racing on practically parallel orbits, 170,000,000 miles apart on opposite sides of the sun.

The comet first crossed the earth's orbit about March 10th at a point where the earth will arrive at the middle of next October, but far above where the earth will be, so to speak, for it will be some 10,000,000 miles above the plane of the ecliptic. In April the comet will emerge from behind the sun, and will become visible to the naked eye in the eastern sky before sunrise.

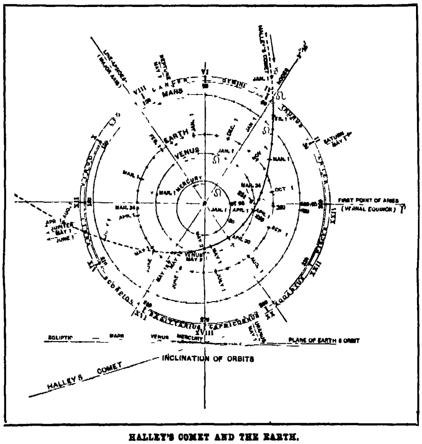
On April 20th, when the comet will swing around the sun, it will be 57,000,000 miles away from the sun. Its velocity will be 26 miles a second. The earth travels at about 19 miles a second. On May 2nd the comet will traverse the orbit of Venus, some 6,000,000 miles above the planet. In other words, an astronomer on Venus would find the comet a far more impressive spectacle than a terrestrial astronomer. As it rushes on, Halley's comet will pass between the earth and sun close to its ascending node. On May 18th the earth will be about 13,000,000 miles away from the nucleus or head as against 5,000,000 miles in 1835. Moreover, on May 18th the earth will be enveloped in the comet's tail for a few hours. A few days later the comet will be visible in the western sky after sunset with a 15 deg. or 20 deg. splendor. After that it will speed away from the solar system. The last glimpse of it with the naked eye will be obtained probably at the end of June. It will not reappear for seventy-five years.

Halley's comet is noteworthy because it was the first comet for which an orbit was plotted and a time table calculated. It has a history more or less identified with the history of human thought and civilization. The superstitious dread with which it was regarded in mediæval and ancient times swayed many a monarch. It was instrumental in forming the politics of Louis le Debonnaire in 837. It blazed in the sky when the Turks threatened to overrun Europe in 1456, and when the Reformation was at its height in 1531. It struck terror to the Saxons under Harold in 1066, when they were conquered by William of Normandy. This fear of the middle ages was dispelled only when Halley made his great prediction in 1682 that the comet would return in 1758, a prediction which was verified after the great astronomer was in his grave.

A comet which has reappeared regularly for over two thousand years must be composed of fairly enduring stuff. Just what its composition may be, the present reappearance will for the first time enable us to tell, for in 1835 the spectroscope was not invented, nor astronomical photography perfected.



THE APPARENT PATH OF HALLEY'S COMET THROUGH THE HEAVENS.



HALLEY'S COMET AND THE EARTH.

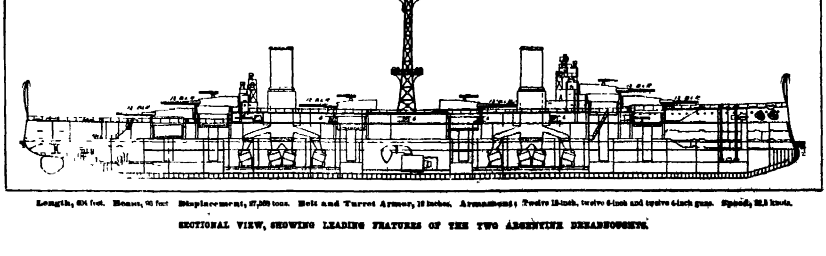
Dots on the orbits show positions of planets and comet every 10 days. Positions for January 1st 1910, are shown thus "Jan. 1." The ascending nodes, or points where the orbits first cross the ecliptic, are shown thus: ☊. Dotted portions of the orbits indicate the part below the ecliptic. The outer circle shows the signs of the zodiac. The celestial (heliocentric) longitude and the right ascension are indicated in hours. The Inclination Diagram shows the great angle of the comet's orbit.

THE NEW ARGENTINE DREADNOUGHTS.

Thanks to two contemporaries devoted to South American interests, La Argentina and The Standard of Buenos Ayres, we are in a position to publish some quite complete information regarding the two new dreadnoughts, contracts for which have recently been secured by the Fore River Company. Comparison will naturally be instituted between them and our latest dreadnoughts, the "Wyoming" and "Oklahoma." They are 50 feet longer, have about 3 feet more beam, about a foot less draft, and their displacement is 1,500 tons greater. The ships are as fully protected, and if expectations are fulfilled, they will have two knots greater speed, a result to which their greater length and finer lines will largely contribute. The armor plan appears to be about the same, with the addition, however, of a certain amount of special protection against under-water attack. Because of the emplacement of the two central turrets diagonally, the end-on fire, both fore and aft, will be double that of our ships, the broadside fire will be about the same.

A study of the inboard profile for which we are indebted to La Argentina, reveals a symmetrical disposition both of the gun and motive-power weights, and one is impressed with the fact that, with the exception of the aftermost pair of guns, the battery is carried high above the water upon a lofty unbroken spar deck extending some 450 feet throughout the length of the ship. Another excellent feature is that the secondary battery is mounted entirely upon the main deck, or one deck higher than in our own "Wyoming." Hence, these guns should be capable of service in practically any weather in which an action could be carried on. The main battery is mounted in two stepped turrets forward and a similar pair aft and in the two turrets placed *en échelon* amidships. The single military mast, built apparently of open steel trusswork, is placed exactly at the center of the ship, and below it are the engine-room compartments containing the propelling turbines. Immediately fore and aft of the engine room are the turret hoists and ammunition rooms for the central pair of turrets. Fore and aft of these are the two separate sets of boiler-room compartments, while fore and aft of these compartments, again, are the turret hoists and ammunition rooms for the forward and after pairs of turrets.

The separation of the one military mast from the neighborhood of the forward smokestack, bridges, conning tower and forward turrets is advantageous, in-



Length, 604 feet. Beam, 96 feet. Displacement, 27,500 tons. Belt and Turret Armor, 12 inches. Armament: Twelve 12-inch, twelve 6-inch and twelve 4-inch guns. Speed, 22.5 knots.

SECTIONAL VIEW, SHOWING LEADING FEATURES OF THE TWO ARGENTINE DREADNOUGHTS.

	Argentine Dreadnought.	U. S. S. "Wyoming."
Length	594 feet	554 feet
Beam	98 feet	93 feet 2½ inches
Draft, normal	27 feet 6 inches	28 feet 6 inches
Displacement	27,500 tons	26,000 tons
Speed	22½ knots	20½ knots
Belt armor	12 inches	12 inches
Turret armor	12 inches	12 inches
Battery	Twelve 12-inch, Twelve 6-inch, Twelve 4-inch	Twelve 12-inch, Twenty-one 5-inch
Fire ahead	Eight 12-inch	Four 12-inch
Fire astern	Eight 12-inch	Four 12-inch
Fire broadside	Twelve 12-inch	Twelve 12-inch

asmuch as it is thereby removed from the favorite aiming point of modern gunnery, which is a little forward of the base of the foremast

The position of the 6-inch battery, with a protection of 8 inches of armor below and 6 inches in front of it, must be considered very satisfactory, although the protection is not equal to the 9 inches afforded to the 5-inch battery on our latest ships. Excellent also is the protection of the smokestack to a height of 15 feet above the spar deck by a special steel plate 1½ inch in thickness.

The following particulars taken from The Standard of Buenos Ayres, will be of interest The main armor belt will extend for 250 feet in the center, and 4 feet 9 inches above and 3 feet 4 inches under the normal water line, the uniform thickness being 12 inches The armored band will extend 75 feet toward poop and bow to the barbettes, but with the thickness of 10 inches only Above the principal belt of armor for the whole length of 400 feet there will be armor of 9 inches in the lower part and 8 inches in the upper part to the height of the main deck The bow and poop will also be protected by armor of 6 and 4 inches respectively On the main deck there will be a casemate with armor of 6 inches, in which the 6 inch guns will be placed The bases of the chimneys will be protected to 15 feet from the deck with a special steel plate 1½ inch thick The total weight of the armor, barbettes, turrets etc will be 7,000 tons The bottom of the ship will be protected against submarine mines with 660 tons of nickel steel The turbine engines will be in three separate and independent compartments, and the boilers will be in six compartments, divided into two groups The capacity of the coal bunkers is 4,000 tons and there will be tanks for 660 tons of petroleum The turbines will develop 39 500 horse-power with 25 millimeters of pressure of air in the boilers This, with a displacement of 27 500 tons, will give a speed of 22½ miles an hour for eight successive hours With this speed the radius of action will be 3,600 miles, at a speed of 15 miles the radius will be 7,200 and with 11 miles an hour 10,100 miles. The cost of each ship will be $11,000,000

THE SCIENTIFIC AMERICAN FLYING MACHINE TROPHY

CONDITIONS FOR 1910

The Scientific American Trophy for heavier-than-air flying machines was offered by the Scientific American for annual competition under the rules and regulations formulated and promulgated by the Aero Club of America in 1907

The first trial for this cup was held at Hammondsport, N Y, on July 4th 1908, by the Aerial Experiment Association of Hammondsport N Y The minimum distance to be covered was one kilometer (3,280 feet) The trophy for 1908 was won by Glenn H Curtiss in the "June Bug," he having made a flight of 5,090 feet This was the first official public flight for a record made in the United States

The trophy was also won for the year 1909 by Glenn H Curtiss, who on July 17th fulfilled the new conditions of the competition for that year by covering a minimum distance of 25 kilometers The actual distance covered was 25 002 miles in 52 minutes 30 seconds, which was considerably in excess of the minimum distance required

Both of these trials were made under the supervision of the Contest Committee of the Aero Club of America

In accordance with the deed of gift which provides that the conditions for each contest for this trophy shall be made progressive in their severity of test in conformity with the progress of aerial navigation, the conditions to be fulfilled by the next person entitled to have his name placed on the trophy shall be a flight of not less than 40 miles across country The contest for 1910 must be held within the United States.

RULES GOVERNING COMPETITIONS FOR THE SCIENTIFIC AMERICAN TROPHY FOR 1910

I The trophy is to be the property of the club and not of the members thereof, except in the event that any one person shall win the trophy three times, in which case it is to become his personal property

Should the trophy be won by the representative of some foreign club affiliated with the Aero Club of America through membership in the International Aeronautic Federation, it shall be held in the custody of such club, but it shall be subject to competition under the same terms and conditions as if it were still held by the Aero Club of America. Should the holding club, for any reason, be disbanded, the custody of the trophy shall revert to the Aero Club of America.

Should a contest or trial under the rules not be held within a year from the date on which a foreign competing machine shall have won the trophy, the foreign aero club having possession of the cup shall give up its custody of the same and shall return the cup to the Aero Club of America, in order that the competition or trial for that year may be held in the United States of America

The conditions under which the competitive tests and trials shall be made shall be determined by the Contest Committee of the Aero Club of America and such conditions shall be made progressive in their severity of test, as far as possible, in order to foster and develop the progress of the art of aerial navigation

II All heavier-than-air machines of any type whatever (aeroplanes helicopters, ornithopters, etc) shall be entitled to compete for the trophy but all machines carrying a balloon or gas-containing envelope for purposes of support are excluded from the competition

III In order to compete for this prize the contestant should file with the Aero Club of America a formal entry, addressed to the club at its headquarters in New York, declaring his intention to compete for the trophy Whether the trial is to be made at

THE SCIENTIFIC AMERICAN FLYING MACHINE TROPHY.

a recognized aeroplane meeting or at a special trial, the contestant should indicate the date upon which he seeks to make a flight. He must also deposit the amount of the fare from New York to the place of trial, and return

A reasonable time must be allowed for the representative of the club to reach the place where the flight is to be held If the trial is to be made within 25 miles of New York city, the amount of the fare will be defrayed by the club In case the Contest Committee find that the place of trial is too far distant, and they are unable to arrange to have an official present, the contestant may be required to hold the trial at some convenient place mutually to be agreed upon

IV The person or committee having charge of the test or trial shall make careful measurements of the distance covered by the flight, and shall prepare a written report of the test or trial, which shall be delivered to the Contest Committee of the Aero Club of America, and in such report shall state fully whether in his opinion the machine can be handled with safety, and, as far as possible, he shall determine the speed attained during the flight. He shall also take into consideration the question of stability and ease of control, and he shall state in his report weather and wind conditions.

V The flights will be made in as calm weather as possible, but the contest committee or its representative will at its discretion order the flight to begin at any time it sees fit, provided the velocity of the wind does not exceed twenty miles an hour The machine may start by running on the ground or upon a track under its own power, but no special launching device will be permitted There is no requirement as to the height above the ground at which the machine must fly

VI Complete specifications of the competing machine, giving weight, supporting surface and power of engines together with a description of the best trial of the machine, shall be forwarded to the Contest Committee at or before the time of making entry for the contest.

VII The trophy shall be awarded for the year 1910 to the contestant making the longest cross-country flight during the year The distance covered must be at least 40 miles as the crow flies, or to a point 20 miles distant, returning to the point of departure

The trophy shall not be awarded unless formal entry for the same has been lodged by the *bona fide* owner of the machine with the Contest Committee of the Aero Club of America in accordance with the conditions elsewhere specified The name and record of the successful contestant shall be appropriately inscribed on the trophy

VIII All tests and trials shall be under the official supervision and direction of the Aero Club of America, and all questions that may arise in regard to such contest or trial shall be decided by the Contest Committee of said club, and its decision in all questions of dispute shall be final, and without right of appeal to a court of law or equity

IX In case the Contest Committee is unable to determine which machine has made the best performance during the year 1910 it shall arrange that a competition between such machines be held, and the machine making the best performance in such test shall be awarded the trophy for the year

X No trial or test for the year 1911 will be allowed until the rules governing the competition for that year have been promulgated

Correspondence.

MR RIEDERER'S PROBLEM.

To the Editor of the Scientific American

Referring to Mr Riederer's puzzle in the Scientific American dated February 19th, 1910 I take the liberty of submitting what I consider to be the most orderly

1 2 3	1 4 5	1 6 7	1 8 9	1 10 11
2 4 6	2 5 7	2 8 11	2 9 10	1 12 13
3 4 7	3 5 6	3 8 10	3 9 11	1 14 15
4 8 12	4 9 13	4 10 14	4 11 15	2 12 15
5 8 13	5 9 14	5 10 15	5 11 12	2 13 14
6 8 15	6 9 12	6 10 13	6 11 14	3 12 14
7 8 14	7 9 15	7 10 12	7 11 13	3 13 15

way of laying out this puzzle I started with No 1 horizontally and used all the figures up to 15 Then I took 2 and used what I could, then 3 4, 5 6 and 7 successively which is about all there is to do

Waverly Iowa H N Woodford.

The Current Supplement.

W P Dreaper's excellent consideration of the artificial silk industry is concluded in the current Supplement, No 1786 Attention has been again directed to the possibilities of radium as a curative agent by Sir William Ramsay and Sir Lauder Brunton For this reason an article on the subject in the current Supplement should be read with interest Lucien Fournier describes the freezing process which was employed in the construction of the Paris Subway The case of Wright versus Paulhan, and some extracts from affidavits and Judge Hand's decision in the case of the Farman and Blériot aeroplanes is concluded H. Thurn writes on airships, wireless telegraphy, and atmospheric electricity Most interesting is an article by T Kume on Japanese pearl culture, in which he considers the pearl historically in Japan, mentions the Oriental bivalves which produce the best pearls, and then describes in detail the method employed by Mikimoto for the artificial culture of pearls Some experiments on the expansion of air by heat are described. Automobilists will read with interest an article on a variable stroke gasoline motor Prof T J J See contributes a thoughtful paper on the origin of the lunar craters, in which he endeavors to show that these wonderful craters may be explained by the impact of some sort of projectiles W Nernst contributes an article on general and physical chemistry in the last forty years.

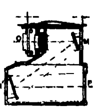
A NEW TELEPHOTO CAMERA

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN

It may seem far easier than it is to construct a camera which will give an enlarged image so as to bring out the details of objects at great distances. To give a large image a long focus lens is required, of four foot focus for example. But a camera to use this lens must be of very great length and weight, and cannot, therefore, be said to be portable.

In the instrument illustrated which was designed on the Vautier Dufour and Schä system, the inventors have solved the problem of preserving the focal length of the lens and at the same time reducing the volume and weight of the apparatus by cutting the focal length into thirds with the aid of two mirrors. At O is the lens which lies in the upper part of the double box. The rays passing through the lens are reflected from the upper mirror *M* placed at the back of the box to the mirror *M'* at the front end of the lower section, and thence to the usual ground glass *P* at the back. In this manner a camera of sixteen inches length is sufficient for a lens of four-foot focus, with an evident saving in weight and reduction of volume. Such an instrument is quite portable. The upper part of the camera is made on the extensible plan, and is drawn up and out of the lower box when the photograph is to be taken.

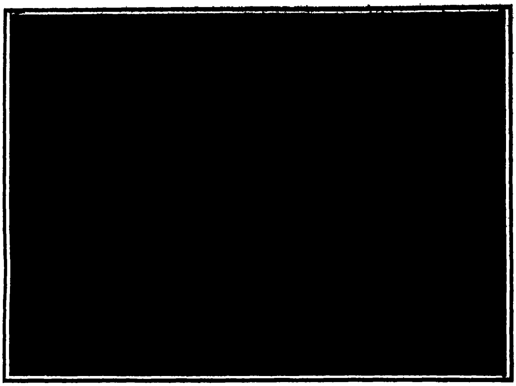
Up to the present time the different combinations of lenses for telephotography have all had one great fault namely, a want of luminosity and consequent difficulty in focusing. It was almost impossible to use such lenses for snap shots. The camera illustrated takes instantaneous views in the usual way. The lens opening is always in ratio with the focal length of the lens, *f* 10 to *f* 12 for the extra rapid. The luminosity is thus always sufficient for instantaneous work. For the photography of inaccessible places, such as mountains or details of architecture or scenes in which the interesting spot is at a great distance from the observer, the new camera performs very good work, as will be noticed in some of the engravings presented here. In a balloon the new system renders it possible to take rapid instantaneous views which would be impossible with an ordinary tele-objective. Such views are very difficult to take, not only because of the distance of the objects, but because of the continual movement of the balloon, which makes rapid snap-shots necessary. Snap-shots can now be taken up to 1-1,000th second which would be quite impossible with any tele-lens with which we are acquainted. At the full opening the present lens gives pictures which are sharp up to the edges of the plate.



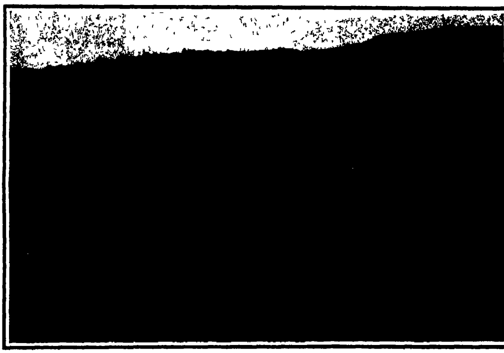
O is the lens, the rays passing through the lens are reflected from the mirror M to the mirror M' and from there to the ground glass P. In this manner a camera of 16 inches in length suffices for a lens of 48 inches focus.

The present camera has already undergone trials in a free balloon on board the balloon "Mars" of the Swiss Aero Club, and the photographer took some very sharp views, which it would have been impossible to obtain with an ordinary apparatus.

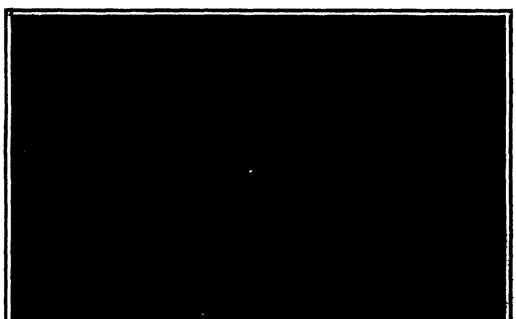
Its use in field work is shown in two of the annexed views representing army manouvers. In the first view, taken with an ordinary camera, the troops in the background can hardly be distinguished, while in the second view we clearly see the individual soldiers and can follow all their movements with ease. One of the views shows a photograph, taken on board the balloon "Mars," of the town of Neuhausen and the Rhine Falls at an altitude of 1,400 meters (4,620 feet) with an ordinary camera. The second view is taken from the same point with the new apparatus. Its use in architectural work is also seen.



The city of Neuhausen and the Rhine Falls taken with an ordinary camera.



A photograph of military maneuvers taken with an ordinary camera.



The city of Neuhausen and the Rhine Falls taken with the Vautier-Dufour camera.

A NEW TELEPHOTO CAMERA.

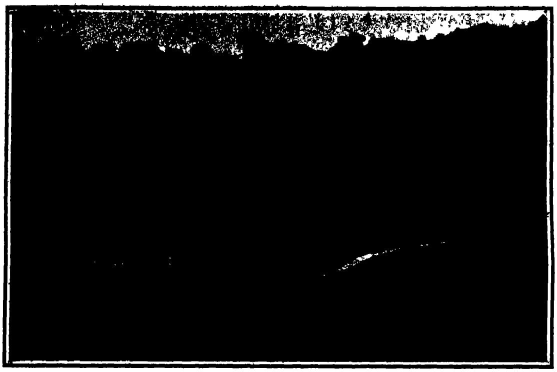
Why Are We Right-Handed?

BY JOHN R. BUSER, A.M., M.D.

From time to time ambidexterity is extolled as generally desirable, and there are to-day educators who consider that development of the left, coequal with that of the right hand should be begun with the entrance of little children in our schools. It is, therefore, perhaps profitable to discuss in what manner right handedness—by which I would here connote right-sidedness in general—has become habitual among 96 per cent of human kind; and whether ambidexterity is really desirable.

The lower animals, at least those which have not been taught tricks, use their fore paws indiscriminately, the cat strikes at a fly or plays with a mouse indifferently with either or both paws; the squirrel manipulates nuts and clings to branches quite as indifferently. Even in monkeys or gorillas, which of all animals use the fore paws mostly as hands, there is no suggestion of preferential use or superior expert-

ness in the left or the right hand, states Dr. G. M Gould, but animals can be tutored to use one or the other paw, the dog is taught to shake hands with the right paw; the monkey to shoot manwise, with the musket butt at the right shoulder Among microcephalic idiots, whose small-headedness is due to arrested development, left-handedness and ambidexterity have been found to reach a proportion of fifty per cent. But as we go up in the evolutionary scale of normal creatures, and as we exclude disease, we find that ambidexterity progressively gives way to single-handedness—generally right-handedness Sir James Crichton Browne observed quite truly some years ago, that "by the superior skill of his right hand man hath gotten himself the victory" in the evolutionary struggle To try to undo his dextral pre-eminence is to make for devolution Glimpses of right-handedness in man, it seems, are manifest in the bronze age and in Paleolithic times It is evident in the art of the ancients—Assyrian Grecian, Egyptian Historic investigation shows that all peoples, however savage, have uniformly used by preference not only one but the same hand—the right. It is said that some races to-day manifest either handedness, but this is in the last degree doubtful Such statements have, for example, been made concerning the Japanese—that they are by law and practice ambidextrous. But Baron Komura has given positive assurance to the contrary Sir James believes it doubtful whether "strictly speaking, complete ambidextry exists in any fully developed and civilized human beings, though sometimes very close approximations to it occur"



Army maneuvers taken with the Vautier-Dufour camera.

Almost indistinguishable in the quadrangle marked in the corresponding picture on page 260.

Most human beings, then, are right-handed, though of course, there are those of great intellectuality and force who are ambidextrous having educated themselves to this end, and are exceptional by reason of the peculiar and special training they have undergone The origin of right handedness will be found, I believe, to lie much deeper than the individual's voluntary selection whether he will use his right hand or his left, or whether he will be ambidextrous, the reason is to be found in human anatomy—in the position of the heart, and in the cerebral structure and organization by which latter all voluntary movements are directed and controlled

The Parthenon taken with an ordinary camera.

Consider in the first place how the heart and its great arteries are left-sided, though in the primordial organism from which we have evolved there was, it seems, no such symmetry The savage, from time immemorial, has protected his heart with his left, his shield arm, but his aggressive manipulations are made with his right, his spear arm The modern savage too, though he bears no shield—which would be useless against modern weapons—fires his musket uniformly (in a double sense) from the right shoulder, sighting with his right eye, the sword also is wielded in the right hand These things are absolutely fixed in our military customs and have been so throughout history.

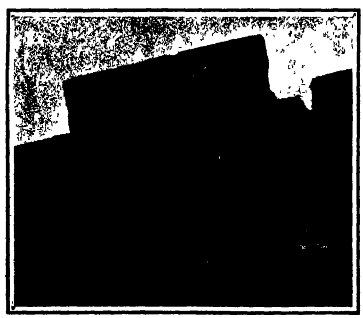
Again, in obedience to the universal need for barter—so Dr Gould points out—the primitive practice was counting with the low numbers, one to ten The fingers of the free dextral hand were first used, and all fingers are now called digits, as are the figures themselves, and the basis of our numbering is the decimal or ten fingered system

The second important fact in human anatomy is that all our voluntary movements are directed and controlled in the cerebral structure and organization The brain has two hemispheres, of which the right presides, by means of certain decussating nerve fibers, over the left side of the body, while the left brain presides over the right side And functional differences in the two sides are connected with and contingent upon differences in the two hemispheres The left brain, in all right handed people, is more highly developed than the right brain It is said that this greater development of the left brain in the right handed is so because the heart being on the left side of the body, sends its blood with greater force and directness to the left brain. It does send the blood more directly into the left side of the neck, but the flow of blood at the base of the brain is so equalized in the "circle of Willis," that the theory here stated can hardly be accepted as conclusive Besides, it is contradicted by the cases of left-handedness (which make up about four per cent of humanity) in which the heart is on the left side, precisely as with the right handed

An extremely important anatomical consideration is that in right-handed people the "speech center" is situated in Broca's convolution in the cortex of the left frontal lobe, while in left-handed people the speech center is in the same position, but in the right frontal lobe Now it has been found that damage to Broca's convolution in the left hemisphere deprived the right handed man of speech, which is unimpaired in the left handed man under the same circumstances, the left handed man would suffer in the same way, were

(Continued on page 268)

Detail of Parthenon taken with telephoto camera.



The effect obtained by ordinary enlargement of a detail in a photograph.

A NEW TELEPHOTO CAMERA

THERMAL TREATMENT OF STEEL INGOTS

BY J. F. SPRINGER

There are two considerable imperfections which accompany the casting of steel ingots. The more conspicuous one is that of the pipe. This is a conical cavity which forms in the upper portion. In Fig 1 we have in the center two longitudinal slabs taken from steel ingots which exhibit the pipe very clearly. The usual explanation of this curious formation regards it as a consequence of contraction. A mold full of molten metal can not be full when the ingot has cooled off. There is in fact a volumetric loss of perhaps 5 per cent. But this does not account for the form of the pipe. Why should it be conical? It has been suggested that perhaps contraction at the moment of solidification controls this matter. To this, however, the answer is made that gray cast iron expands at this moment and yet it forms a pipe. Whether steel expands or contracts in the act of freezing no one seems to know with any certainty. But steel ingots form decided pipes as any steel makers will tell you. Prof Howe has proposed an explanation which may help us somewhat. When the exceedingly hot steel is teemed into the mold it finds the walls and bottom of that mold at a very low temperature, comparatively. These molds involve quite a large mass of material as may be understood by noting the substantial character of those shown in Fig 2. Their cooling effect is consequently a considerable factor. The first solid metal of this cooling ingot will constitute a shell conforming to the sides and bottom of the mold and containing a heavy mass of molten steel. Now, whether expansion or contraction takes place at the very moment of freezing, the steel of this shell will undoubtedly steadily contract. As this goes on, it meets resistance from the weight of the liquid within. Prof Howe thinks that at times the elastic limit will be exceeded. There would thus arise a tendency to a "set," with the shell upon final cooling larger in cross section than would otherwise have been the case. Of course, the solidifying material contacting with the shell on the inside will cling to it. And further, one may conceive that, as the shell thickens, successive layers will come to normal temperature with expanded cross sections, for reasons similar to those controlling the outer shell. If so much is granted, it is easy to see that there is a tendency to leave the region of the axis empty. There is, however, another tendency at work seeking to nullify this. This is the gravitation of the fluid metal. This tends to fill up the pipe at the bottom. And so the lower portion of the ingot becomes solid throughout. But this transference of material from points above to points below impoverishes the upper portion, with the result that a pipe really forms, and that it is more extensive in cross section as one ascends.

To eliminate the pipe many procedures have been employed. These divide themselves into the mechanical methods and thermal ones. Perhaps the most successful process which has yet found its way into commercial practice is the Harmet procedure described in an article by the author in the SCIENTIFIC AMERICAN for May 29th, 1909. Methods, such as this, operate with a view of eliminating the pipe through the forcing in of its walls upon themselves while the interior of the ingot is in a liquid or plastic condition. The elaborateness of the apparatus necessary, and the length of time required, are serious considerations

Fig. 1.—The six transverse slabs and the right-hand vertical slab were poured by the hot-top process.

which operate against some, at least, of the mechanical processes. But efforts have been made to solve the problem by thermal means. If the steel at the top could be kept highly liquid until the lower part of the ingot becomes solid, then with such a reservoir perhaps the pipe could be progressively filled up as it formed. Upon some such fundamental idea the thermal processes depend. Krupp is said to have poured molten slag upon the tops of the ingots. Apparently

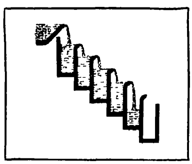


Fig. 3.—Sauveur's overflow method of pouring ingots.

but little is known of the measure of success. This might, perhaps, provide a good method. The slag would furnish considerable heat. Its lower specific gravity would prevent any mechanical penetration into the steel of the ingots. It has been found that, if ingots are cast, having a considerable taper with the large end up, the pipe will be reduced. In fact, a very considerable shortening has been accomplished in this way. Experiments have been tried where the metal was steel, zinc, and wax. All show improvement. No doubt this effect is due to the retardation of the cooling thus effected at the top by the provision there of a larger mass of metal. That is to say, the pipe is shortened if cooling is accomplished from below. There is, however, a strong objection to this method in that, although its length is reduced, the pipe is now located in the large end, and thus involves more metal in proportion to its length. Its corrective influence is thus discounted somewhat. There is another objection on the score that this method would involve complications in stripping the molds from the ingots. However, that a large source of heat at the top is of advantage is further testified to by certain experiences had with thermit. It has been found that by introducing this compound by means of a rod into the upper portion of an ingot, the pipe could be somewhat shortened. This result is, no doubt, due to the considerable heat set free upon the chemical reaction taking place between the thermit and the molten steel. The experiments with wax ingots carried out by Profs. Howe and Stoughton give evidence in the same direction. An account of these experiments may be found in an article by the present writer in the SCIENTIFIC AMERICAN for April 24th, 1909, where the marked difference in the length of pipe effected by casting with the big end up and the reverse is well shown by ingots Nos 4 and 5. In the cases of ingots Nos 6 and 7 we have the contrast realized by keeping the temperature hot at the top and cool at the bottom and *vice versa*. The difference measured in percentage of ingot preserved from piping amounted to 48 per cent. This advantage of nearly one-half the whole ingot was in favor of the hot top. Of course, these experiments were carried out in wax and not in steel. At the same time, they have their weight as corroborative evidence. Some years ago experiments were tried with steel by what may be called the overflow method. This is Prof Sauveur's process. A number of molds were arranged in a way not unlike that disclosed in Fig 3. By pouring continuously into the one on the left all may be filled. It was thus found upon one or more occasions that the first and second ingots whose heads were for the longest period kept hot and provided with liquid supplies of steel, disclosed no pipes. The next two had small pipes, involving about 4 or 5 per cent of the ingot length.

Now all these experiences prepare us to expect a decided success from the Riemer hot top process as used in Germany. This inventor applies a gas furnace to the ingot top. Apparently, however, others had had a similar idea. It would seem that their processes received but inconsiderable attention. Now Riemer not only applies his furnace but he applies it at once. Further, he provides an immense supply of heat. He thus prevents any tendency to the formation of a crust over the top. However whether we understand why it should seem necessary to furnish heat not only in great amount but with great promptness the fact

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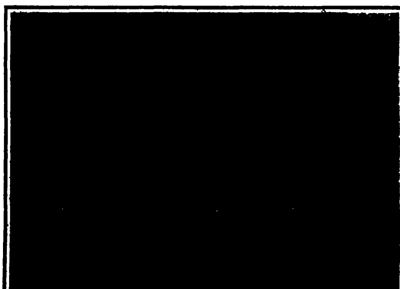


Fig. 2.—Gas furnace is here being used to pre-heat the mold before pouring the ingot.

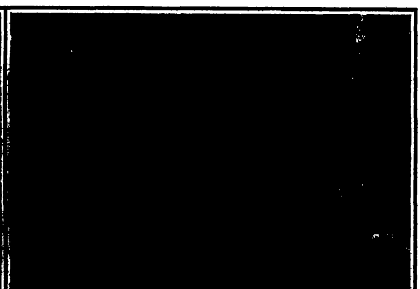


Fig. 4.—Gas furnace in operation heating the top of a 16-ton ingot while metal is being poured into the mold.

PREVENTION OF PIPES AND SEGREGATION BY KEEPING TOP OF INGOT AT FUSION POINT DURING POURING.

EGGS OF CURIOUS FORMS

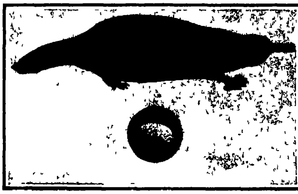
BY PERCY COLLINS

When we consider that with the exception of the class mammalia, practically every creature dwelling upon the earth at the present moment began life within the walls of an envelope popularly termed an egg, it becomes clear that the appellation must do duty for a very varied assemblage of objects. Not many people are aware that even the mammalia (or animals that suckle their young) include several egg-layers, yet such is undoubtedly the case These strange creatures are all native of that continent of animal curiosities, namely, Australia, although two of them—the echidnas—are also found in New Guinea. These echidnas are queer ant-eater-like animals, of whose habits comparatively little seems to be known, save that they subsist mainly on insects, and that they really do lay eggs.

Much more detailed accounts are extant respecting the habits of the duck bill *Ornithorhynchus paradoxus* (as science terms it) is not unlike a gigantic mole in shape, save that it possesses a remarkable tail and feet and bill of duck like design Its habits closely resemble those of the common water rat. Frequenting the streams of southern and eastern Australia, it makes its nest in a burrow in the bank Here Mother Duck-bill lays two white, flexible-shelled eggs, about three-quarters of an inch in length When first hatched, the tiny duck-bills are both blind and naked, but in process of time they acquire the adult characteristic, and issue from the nest hole to feed and frolic in the river with their parents

Leaving now the mammalia we find that all known birds lay eggs, the largest being that of the ostrich Many of these eggs come from Africa, and after being scratched, painted, "poker worked" or otherwise adorned, are used for decorative purposes. Thus we are all familiar with them, and can realise that the contents of one would form a bountiful meal But the ostrich's egg would have appeared quite small be-

(*Continued on page 269*)


Duck-bill and egg.


Male midwife frog.


Cuckoo and its egg compared with kiwi and its egg


1 Egg cluster of common whelk.
2 Egg-chain of turret shell.


Egg-case of dog-fish.


Egg-case of hammerhead shark

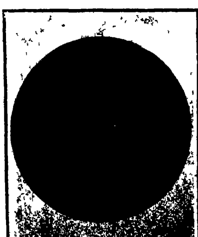

Typical cluster of snakes' eggs

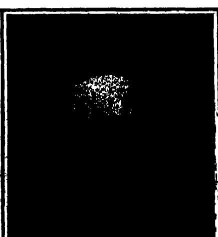

Eggs of housefly (magnified).

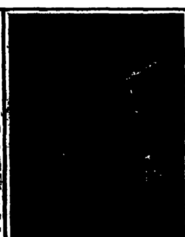

West Indian *Bulimus* shell and egg


Eggs of a moth (magnified).


Egg clusters of *Mantis* or "rear-horse"


Eggs of parasite of hornbill (magnified).


Egg of gopher tortoise—a perfect sphere.


Egg of parasite of domestic fowl (magnified).


Egg of parasite of a bird louse (magnified).

EGGS OF CURIOUS FORMS.

CURIOSITIES OF SCIENCE AND INVENTION

MOTOR-CYCLE AUXILIARY FOR BICYCLES

A power attachment for bicycles has recently been invented which calls for no structural alterations to be made in the ordinary bicycle and which can be attached or detached in a few minutes The device comprises a small auxiliary wheel 20 inches in diameter fitted with a light motor which is connected to the rear wheel of the bicycle. An ingenious pivoting

A POWER ATTACHMENT FOR BICYCLES.

arrangement allows the wheel a peculiar lateral and vertical movement, so that the steering of the machine is in no way affected and permits the wheel to glide over obstacles or rough ground without transmitting any shock or vibration to the rider

The motor is a small air-cooled, horizontal, two-stroke engine with a specially designed hub to which the power is transmitted through a six to one reducing gear The magneto ignition and vaporizer are mounted on the same plane, and in line with the engine, so that the whole is rendered very compact

The engine is valveless, the inlet and exhaust being governed by ports, alternately covered and uncovered by the piston It develops 1¼ horse-power

To attach the motor wheel to the ordinary cycle, it is only necessary to remove the nut of the back wheel spindle on the chain side of the machine, and to attach the frame of the auxiliary wheel to the spindle and bolt it up—an operation occupying a few moments A single-lever regulator controlling the motor is clipped to the handle bar, the connection with the motor mechanism being a flexible wire This single lever controls the action of the engine to a nicety

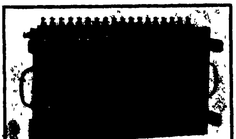
The wheel complete weighs only 35 pounds, and the motor is capable of driving the bicycle at an average speed of 16 miles per hour on an ordinary road, with a maximum speed of about 18 miles on the level The fuel tank in the mud guard is of sufficient capacity to carry the motor 100 miles

A NOVEL HIGH-POTENTIAL PRIMARY BATTERY.

A new and ingenious high potential primary battery, the purpose of which is to supply electric charges at known potentials, was recently exhibited before the English Physical Society The positive element of each cell consists of a small carbon rod, while a strip of pure zinc comprises the negative element, the electrolyte being a solution of calcium chloride

The connected ends of the elements, which are mounted in parallel rows of 25, are buried in paraffin.

A HYGROSCOPIC HIGH-POTENTIAL BATTERY.



THE BATTERY INVERTED TO SHOW THE ZINC AND CARBON ELEMENTS.

Contact between the free carbon and the zinc elements is just broken by a small pellet of paraffin, and the liquid is retained between them by capillarity

The electrolyte comprises a saturated solution of calcium chloride which has been exposed to the air. Being hygroscopic it will absorb water until a certain equilibrium strength is obtained, this factor depending on the humidity of the air and the temperature. The electromotive force of each cell differs from one volt by only two or three per cent if exposed to very different conditions of temperature and humidity, but it has been kept steady to within 0 1 per cent for two or three consecutive days.

In conjunction with an electrostatic voltmeter, the battery is very convenient for the following purposes In all experiments involving the use of a quadrant voltmeter, as the needle can be charged to any desired voltage up to 1,000 volts, since the battery is so designed that one or any number of elements can be taken, for the comparison and calibration of electrostatic voltmeters, for the comparison of capacities, and for the measurement of high resistances by the method of discharging a condenser through them and noting the time taken

DETECTOR FOR FIRE-ALARM BOXES.

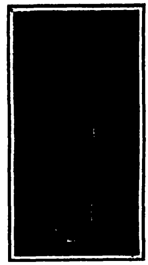
The problem of so designing a fire alarm box that it can be opened and operated by any one in an emergency and yet will tend to prevent the sounding of false alarms, is one that has engaged the attention of inventors for many years A very ingenious solution of the problem is presented in the accompanying illustrations. The alarm box is closed by a cover which has to be raised as shown in one of the illustrations to permit the operator to insert his hand through an opening and release the alarm mechanism At the moment of the release a handcuff closes over the wrist of the operator, as illustrated in another photograph The handcuff is not chained to the alarm box; for this would make a prisoner of the operator of the alarm, whose services might be badly needed at the fire Instead, however, the handcuff serves merely for identification It is made of such form that it cannot be concealed under the coat sleeve and it betrays the sounder of the alarm to the general public, and is an honor to a man unless the alarm is a false one Not until the fire chief has arrived with a special key to fit the handcuff may the device be removed This system is also applicable to boxes which are locked. It frequently happens in such cases that the keys are loaned out and it is impossible to determine who sounded the alarm even when it is known whose key is missing

The alarm box closed. Operating the alarm The operator handcuffed.

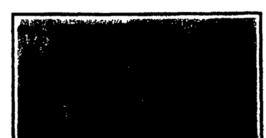
DETECTOR FOR FIRE-ALARM BOXES.

CAPPING MILK BOTTLES BY MACHINE.

Greater precautions must be taken in handling milk than any other form of food, because it is such an excellent medium for breeding germs Hand work is always objectionable because of possible contamination from unclean fingers. Heretofore milk bottles have commonly been capped by hand. Now a simple machine has been invented for doing this work which should be of value to small as well as large dealers. The machine consists of a magazine and a means of taking one cap at a time from the magazine and pressing it firmly into place on the top of the milk bottle. It not only adds to cleanliness in dairies, but saves time, inasmuch as it is many times more rapid in the operation of capping bottles than the human hands. One type is portable and is operated by a quick squeeze of the handle The other type consists of a battery of cappers which will operate to cap a number of bottles at once The magazine takes the caps in packages from the machine which made them and obviates the necessity of handling the cap itself



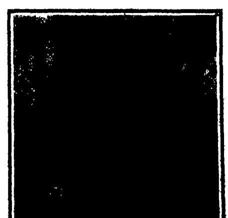
PORTABLE BOTTLE-CAPPING MACHINE



A MACHINE FOR CAPPING FOUR MILK BOTTLES AT A TIME.

UMBRELLA SHELTER FOR AUTOMOBILES

It is impossible to enter a vehicle on a very rainy day without getting wet, because the umbrella must be lowered before one can step inside Surely it is just as necessary to provide vehicles with some sort of a shelter, such as the awning of a store or the marquee of a public building However, anything projecting from the side of a vehicle would be objectionable The difficulty is surmounted quite cleverly in the automobile, which is illustrated in the accompanying engraving. A collapsible awning is attached to the top of the automobile, and also to the top of the door, so that when the door is opened to admit the passenger or to allow a passenger to alight, the awning will open and protect him from the rain while he is raising or lowering his umbrella. When the door is closed, the awning shuts up like a fan.



UMBRELLA SHELTER FOR AUTOMOBILES.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

ARCH SUPPORT.—P HAMMER, Marlboro, N. Y An object of this invention is to provide an attachment for the shoe which will comfortably support the arch or instep at all points, and will at the same time provide adequate ventilation for the interior of the shoe without admitting water from the streets in which the shoe might happen to be placed.

Of General Interest.

FOUNTAIN-PEN —C H. MARTLING, and C. DUNN, New York, N Y In this instance the aim is to provide a fountain pen having a screw cap which forms an ink tight joint when in position to cover the pen point, so that the ink cannot escape to any part of the holder or pen section, and in which evaporation of the ink in the barrel is prevented.

HELIOGRAPH —T J MAURA, New York, N Y An object of the invention is to provide novel details of construction for an instrument which will reflect light rays from the sun or an artificial source, in radial lines, towards all points of the compass, and more particularly in a horizontal plane

TREE-SPRAYER —F G HAYES, Sharon, Pa Mr Hayes provides a light apparatus adapted to be operated from a position much lower than the usual spraying towers, provides an apparatus for directing the fluid being sprayed, which may be extended or retracted from the operating station, provides for extending and retracting the operating position of the spraying device and provides a sprayer operable by one person.

SUPPORT FOR DISPLAY MATTER —T HARRINGTON, New York, N Y This invention is especially applicable to theatrical advertising for use in hotels, railroad stations, and other public or semi public places in large cities, although it is evident that the invention may be employed in connection with advertisements, signs, or displays of other character or matter

RECEPTACLE-CLOSURE —R G ADAMS, Hayward, Cal The object here is to construct the closure so that the bail and the cam member may be turned relatively to each other and to the cover and receptacle, whereby the parts may be easily and expeditiously assembled, and, further, to so construct the bail and cam member that they may be stamped from sheet metal and the cost of manufacture thus brought within the limits of practice

MANUFACTURE OF BREAD —C A HEUDEBERT, 8 Rue du Chemin de Fer, Nanterre, Seine France This invention relates to a novel gluten bread, very rich in nitrogenized substances produced by the incorporation of a soluble casein obtained from milk It is of agreeable taste such as is unattainable in the ordinary process Mr Heudebert has also invented a process which permits of adding the casein in large proportions to flour rich in gluten and permits the complete incorporation of the casein, thus avoiding the formation of lumps.

Hardware and Tools.

WIRE ROPE CLAMP —C A MCCARTHY, Hattiesburg, Miss. One of the important features of this invention is the means whereby the inventor provides a practical one bolt clamp, and in doing this he arranges grooves in close proximity to the bolt holes so that the strain of the bolt is exerted almost directly upon the cables when the latter are in the grooves and upon the outer side of the socket receiving the bolt head he provides a square portion which forms a wrench head, so that the wrench can be put on the head and coöperate with the wrench on the nut so as to tighten the clamp upon the cables.

ATTACHMENT FOR ANVILS.—A R. EVERETT Brookfield Township, Ohio. The object of the invention is to provide a device which can be operatively positioned on an anvil by means of a treadle, thus obviating the necessity of the operator using his hands for this purpose, and which can be inoperatively disposed when not in use

BUCKLE.—J F DUNN, New York N Y In its use as a belt buckle there is a possibility of ornamentation of the exposed portion. In the present instance the body portion of the buckle is formed from a solid plate, the outer surface of which is continuous and adapted to form a surface for ornamentation, such as engravings of initials, embossing, or producing repoussé effects.

Household Utilities.

MOP AND BRUSH HOLDER.—F. DEHLING, Portland, Ore This holder is adapted to receive and hold mops, rags, or scrubbing brushes, the holder is readily and quickly adjustable for holding articles of various sizes and characters, and is also adapted to maintain an adjustable and resilient grasp upon the article used in connection therewith.

Machines and Mechanical Devices.

METHOD FOR CASTING METAL BARS, WIRES, AND PIPES —F W. WINNE, Han-Yang, China. This is an improved method of casting metal bars, wires, and pipes of any length and diameter and of any cross-sectional shape, which is done by passing the metal in a molten state into a chilling mold and revolves the mold about a point, whereby the metal, after being chilled, will be assisted in its discharge from the mold by the centrifugal force developed by the revolution.

GLASS-MOLDING MACHINE.—W J MILLER, Coffeyville, Kan. The object here is to convert semi-automatic machines of a certain type into practically automatic machines. The invention consists in part of a pair of shears arranged at the charging position and adapted to cut off the glass as it is inserted into molds by the gatherer the shears being actuated by the punty or pontel as the glass is placed in the mold

NOTE.—Copies of any of these patents will be furnished by Munn & Co for ten cents each. Please state the name of the patentee title of the invention, and date of this paper

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 15, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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A TRIP IN THE LARGEST BALLOON.

(*Continued from page 256.*)

thing else was a midsummer night's dream. It was only by an effort of reason, or when, through a powerful glass, we distinguished animals in motion, that we realized the home of seven hundred thousand souls to be other than a microscopically beautiful toy

"When nearly above the office of the Inquirer, we celebrated this occasion by flying our ballast and shooting upward, which turned us more to the east, and we were above the Delaware, at an altitude of about a mile Here we verified the fact that we could see with the naked eye the bottom of the river, and with a large spyglass clearly distinguished the great stones in its bed

"Indeed, one of our fellow voyagers insisted upon it that he observed the motions of the fish. Certain it was that the ripple of the plying steamers was most marked, and then we turned to the shipping Having taken a patriotic squint at the Island of Smith, and the still more celebrated Tinicum, we reached the Jersey side at five minutes past six, observing Camden in all its glory The current took us more directly toward the east, and we for half an hour or more followed closely the Camden and Atlantic Railroad, which could only be distinguished from the turnpikes by the aid of a glass. In the moving panorama, the fertile fields of East Jersey formed a most beautiful portion with the Rancocas and Cooper's Creek winding snakelike through wee oblong inmiosures, distinguished only by the different colors of ripe wheat, growing corn, and other tokens of peace and plenty Toward the ocean, a bank of cumulus clouds rose up, and in the west the city was growing dim. We passed over Haddonfield and near Long-a-coming and Waterford, then began to go much higher and faster, having passed right through a fleecy cloud Beneath us stretched almost interminable pine forests, with the white sand sparkling here and there in tiny patches We were at this time at the highest altitude attained during the trip, about three miles, and moving to the east at the rate of at least sixty miles an hour Here the earth appeared convex instead of concave, a phenomenon often observed and accounted for, but none the less curious, and the spirits of the party became almost as high as the barometric location of their bodies We individually got up the ladder into the hoop and insisted on singing songs, which, owing to the rarefaction of the air and the echo from the balloon, had quite a stentorian effect At this point, as we were far above the smoky haze surrounding the earth, and also the region of clouds, the sky looked more beautifully blue and vivid than can be conceived. The moon was almost as bright as it is usually at night, and the sun, which was nearly set to the poor people below, gave to the few clouds tints to us hitherto unknown

"We may here mention that during the voyage we brought 'Sol' up and down several times, thus having a variety of sunrises and sunsets within the space of minutes The atmosphere, even at our greatest elevation, was not so cold as was expected, owing to the rays of the sun being generally refracted from the hazy clouds below The chief physical manifestation of our situation was in the ears, for when descending from a more rarefied to a denser atmosphere there was a whizzing, much like that in the diving, and from the same cause.

"Although it had been the aeronauts' intention to reach the ocean, which now was visible, the sails on it being seen by the telescope, yet a delay of two hours, occasioned by the vastness of the preparations before starting, limited the time so that it was an alternative to land on a somewhat uninhabited coast without daylight to direct us to a proper spot, or take the back track. The latter course was most prudent in reference to the securing of the balloon, and as affording

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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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better opportunities for its conveyance to Philadelphia So we came down very fast, aided more than was entirely desired by the falling dews, and the contraction of the gas after the sun's rays had so much diminished However by a wholesale throwing off of ballast, we kept up at a safe distance proceeding in a curve to the northwest, until observing that a crowd was gathering from all points of the compass in the neighborhood of Medford evidently calculating on our descent and shouting loud invitations, we gratified them and promised their assistance. A large number of willing men caught hold of our long trailing rope by Mr Lowe's direction Our gas was allowed to escape freely, and we landed on a large sand bar one of the best places that could have been selected, at a quarter past eight after about sixty miles of the pleasantest voyage it is possible for man, the unwinged bird, to take"

VERTICAL PHOTOGRAPHY.

(Concluded from page 256)
ground is placed under the glass supporting the article to be photographed. The distance between the support and the background varies from three inches to eighteen inches The greater the distance the less reflection The color of the background is generally determined by the color of the object to be photographed When working under the subject, the light can be reflected under, rendering the background more tense, or on the subject proper, giving not only more illumination but illumination of greater uniformity Some subjects require a neutral ground. In this case the photographer will change his background many times during exposure He may start out for instance, with a pure white ground on top and remove grounds which are piled one on top of another until he passes through many shades, ending the exposure with probably a vivid red This changing of backgrounds during an exposure will often bring out an object that would have otherwise been flat

Cameras are manufactured especially for work of this nature and have scales of measurements so arranged that the ground glass support is part of the camera proper but movable either way with a thumb screw, so that an allowance can be made for objects of various thicknesses By attaching the support to the camera the camera can be swung or revolved during the exposure giving a uniform illumination to the subject. The camera may be supported by a tripod in a vertical position, as shown in the illustration When in the field the camera may be suspended from a tree limb

A stand, such as shown in the illustration, may be easily made and will answer all purposes admirably Any camera can be thus used with good results

A tilting tripod head which is simple in construction and inexpensive in cost, may be used in this style of photography to a good advantage In many cases most pleasing results have been secured by this simple device A sheet of glass for a background a tilting top for the tripod, and the outfit is complete

INTERNAL COMBUSTION PUMP

(Concluded from page 257)
of the column of water cannot be suddenly arrested hence the pressure in C tends to fall below that of the atmosphere and the exhaust valve E opens as well as the water valves V Water rushes in through the water valves, mostly to follow the moving column in pipe D, but partly to rise in chamber C, in an effort to reach the same level within that chamber as in the suction tank When the kinetic energy of the moving column gas has expended itself by forcing water into the high level tank, it comes to rest, and, there being nothing to prevent a re-

turn flow, the column starts to move back toward the pump, and gains velocity in this movement until the water reaches the level of the exhaust valve, which it shuts by impact. The result is that a certain quantity of burnt products of combustion becomes imprisoned in the cushion space F and the energy of the moving column is expended in compressing this gas cushion to a greater pressure than that due to the static head of the water in the elevated tank E T. Consequently a second outward movement of the column of water takes place, and when the water reaches the level of valve E the pressure in the space F is once more atmospheric, and further movement of the water opens valve A by suction against a light spring, and draws in a fresh gaseous charge. If there were no friction the water would fall to the same level as that from which the last upward motion started, but the amount of combustible charge drawn in is slightly less than this movement would represent. Once again the column of water returns under the elevated tank pressure and compresses the charge in the combustion chamber which is then ignited at the moment of maximum compression, and the same cycle of operations is repeated.

The ignition is timed by a small apparatus somewhat resembling an ordinary engine indicator, which closes the electric ignition circuit at the point of maximum compression, an ordinary small battery, trembler coil, and sparking plug as are used in automobile practice.

In starting the pump for the first time, compressed air is allowed to flow into the combustion chamber until the volume of air introduced is rather larger than the usual charge. The exhaust valve is then suddenly opened by means of a hand lever, and the escape of the compressed air permits a movement of the water column, which gives the cushion and suction strokes, and so draws in a fresh combustible charge, which, when the current is switched on and consequently fired, starts the pump working regularly. When the pump is stopped in the usual way in regular work, it always stops with a fresh charge of explosive mixture present in the combustion chamber, so that it is only necessary to switch on the current and the pump is started up. This enables the pump to be set in motion from the switchboard and without any preliminaries whatever.

The pump has been severely tested, and is now in regular daily work at a large pumping installation in the Midlands, giving complete satisfaction. The absence of all complicated gearing such as exists in the ordinary explosion motor is an outstanding feature, and guards the engine against breakdown, the only part that could fail being possibly a defective mushroom valve or spring. Wear and tear is also reduced to an insignificant quantity, and the troubles incidental to lubrication are overcome.

In its simplest form the apparatus converts gas power into hydraulic power, and may, therefore, be called a gas pump, but if the power is to be taken off a rotating shaft, the high pressure water is passed through a water turbine, and so back to the apparatus to be continually circulated. The invention can also be applied with equal facility and efficiency for the compression of air.

The pump has been elaborately described by the inventor in a paper published in the SCIENTIFIC AMERICAN SUPPLEMENT.

RAPID TRANSIT BY BELT CONVEYOR.

(*Continued from page 257.*)

with transverse shafts which carry the driving wheels of the platform. The gradation in the rate of speed of the sections of the platform is secured by varying the diameter of these driving wheels, which are 8 inches in diameter for the 3-mile, 16 inches in diameter for the 6-mile, and 24 inches in diameter for the 9-mile platform. The driving wheels are covered with rubber, as are the horizontal centering guide wheels, and consequently the motion of the platform will be both smooth and silent. The successive sections are coupled together by means of links 46 inches in length, and the coupling pins are placed at the center, from which the curves of the abutting ends of the platform sections are struck, consequently, the opening between the joints may be reduced to a minimum, and a smooth surface presented for walking, with no open spaces to bewilder or trip the passenger.

The passenger-carrying capacity of the moving platform is just double the maximum capacity of the present Subway trains. According to the figures of the Public Service Commission, the total rush-hour capacity of the five-car local trains per hour is 22,500 and of the eight-car express trains 36,000, whereas the moving platform, according to their estimate, would carry 73,500 passengers per hour. They state furthermore that for all distances less than four miles the moving platform is a quicker and more convenient mode of conveyance than the present local train service and even quicker than the local and express service combined, since a passenger may reach Times Square Station, from any local station south of Fourteenth Street (that is, supposing a moving platform were installed on a north and south avenue) quicker by the moving platform than by the local and express trains of the present Subway.

In conclusion, however, we would sound a note of warning with regard to the possible interference of any moving platform subway that may be built with any future extensions of the present Subway. In selecting the route, care should be taken to choose a location where the moving platform subway will not block any of the future through lines which must ultimately be built on practically every avenue in New York city.

Why Are We Right-Handed?

(*Concluded from page 261.*)

the lesion on the right side. The hand and arm centers in the brain are intimately linked in the cortex with the speech centers. And certainly Crichton Browne is correct in the inference that the preferential use of the right hand and arms in voluntary movements is due to the leading part taken by the left brain. "We could not get rid of our right-handedness, try how we might, it is woven in the brain." And this, I believe, is the conclusion to which we must scientifically arrive. "In the curious disease *aphasia*, in which one forgets words, the lesion lies in Broca's convolution, one cannot say cup, for example, though one sees a cup, but when the right hand touches the cup, the patient at once utters its name."

Here one reflects. In the process of evolution, did the heart tend to be on the left side, and the left brain tend to greater development, because the right hand came to be the most used? Or did the right hand come to be most used, because of these heart and left brain phenomena? I am, for my part, of the former opinion; the heart on the left side, and the greater left-brain development, are effect rather than cause, coming gradually to pass as man, in the struggle for the survival of the fittest, found right-handedness more and more advantageous.

Of course, there are professions and trades in which a certain amount of ambidexterity is essential. For example, the pianist, in playing the fugues of Bach, must produce with the left hand almost the same tones as does the right, and has to work a little harder too, for the bass notes of the piano are more thickly wired than the treble. A certain amount of ambidexterity is essential in the surgeon. Yet this gift has its disadvantages, withal; as when a colleague skilled in this way admitted to me that before doing a thing he waited appre-

[whi]le time in wondering which hand he [shou]ld employ. But it is rarely really [es]sential that such ambidexterity be acquired.

Finally, it may be objected, in favor of general education in ambidexterity. Suppose one loses his arm, and that such an unfortunate be a clerk, who must earn his living by writing. Such contingencies are almost as rare as the famous one by which Mrs. Brown justified to her husband her junk-shop purchase of a brass sign stamped "John Jones, Undertaker." "Our daughter will soon be of marriagable age, she *may* marry an undertaker whose name *may* be Jones, possibly John Jones, think how handy the sign will then be." In those rare cases of right handed mutilation there will in time follow, through education and practice, an adequate development of the right brain, just as if the unfortunate had been left-handed.

TREATMENT OF STEEL INGOTS.

(*Concluded from page 262.*)

remains that by doing so Riemer has been able to demonstrate his success in pipe elimination on a considerable and commercial scale. A large number of steel shafts, the steel for which was made by this process and with which the discard was kept at 10 per cent or less, have successfully passed the British Board of Trade requirements. Indeed, a reference to Fig. 1 shows an ingot, treated by this method, in six transverse slabs on the right and left. The slab shown on the upper left hand came from near the top of the ingot. The longitudinal slab to the right of the center of the figure is from another ingot treated by the same hot-top procedure. The inconsiderable depth of the pipe seems pretty evident. It extends perhaps 10 per cent of the total length. But the actual percentage of steel involved is evidently much less than 10 per cent of the total.

We have in Figs. 2 and 4 two views of the gas furnace. There is an eye at the top which facilitates movement of the apparatus. Through two pipes—seen to advantage in Fig. 4—the gas and air enter. The air is under pressure. In cases where it seems desirable to do so, the furnace may be employed as a means of heating the top of the mold preparatory to teeming the steel into it. The apparatus may then be let down until its lower edge is well inside the mouth of the mold, when the pouring of the steel may be performed without removal of the furnace. There is thus ample opportunity to begin action without delay. However, it is regarded as important to have not only prompt application, but an intense heat at once. This requirement is met by preheating both gas and air. In fact, heat may be applied in such intensity as to raise the temperature of the top of the ingot above the point of fusion. It has been found unnecessary to prolong the treatment until solidification is completed. This is a favorable item, as thus the apparatus is released for other service, to which its portable character makes it applicable. In Fig. 4 the furnace is in operation heating the head of a 50-ton ingot. It will be understood that in this view the bulk of the mold is invisible. The naked flames play upon the metal at the top of the ingot. The preheating of the top of the mold tends not only to conserve the heat of the molten steels, but also to prevent heat loss by conduction from the gas flames. The furnace is being used in Fig. 2 for the purpose of preheating. However, the ingot is, in this case, said to be present.

Now in all procedure for the elimination of the pipe, we must not reach final conclusions as to their success without inquiring as to the segregation. The segregation is a locality where the steel has an excess of carbon, sulphur, phosphorus, etc., beyond the average contained in the ingot as a whole. Ordinarily, it should be removed. As it is usually located near the tail of the pipe, it may be disposed of by cropping the ingot a little below that point. However, it is well to investigate this question with some thoroughness, as the method of treatment itself may, conceivably, introduce variations from the rule. Steel of uniform composition is wanted. An ingot cast by the hot-top process was investigated as to its composition. The average carbon content should have been 0.25 per cent. By taking samples along the axis all but one were found to contain carbon in percentages running from 0.23 per cent to 0.25 per cent. The exception was close under the tail of the pipe. Its carbon percentage was 0.41 per cent. Similar results were found for sulphur and phosphorus. Thus they existed in the segregate in percentages about three and one-half or four times what they did below it.

EGGS OF CURIOUS FORMS.

(*Continued from page 263.*)

side the extinct Madagascar bird, the Epyornis, which measured more than thirty inches in its smallest circumference.

The smallest birds' eggs are those of the minute species of humming birds, which are smaller than the eggs of certain kinds of tropical beetles. But the common cuckoo lays the relatively smallest egg. That is to say while the jackdaw and the cuckoo are about equal in size, the former's egg is five or six times larger than the latter's. The fact that the cuckoo is wont to deposit its eggs in the nests of birds which are usually much smaller than itself doubtless accounts for this. The relatively largest egg is laid by the kiwi, a strange wingless New Zealand bird. The egg is no less than five inches long, although the extreme length of the bird itself is only twenty-seven inches.

Reptiles' eggs are not very attractive objects. In the case of crocodiles and many kinds of tortoises they are pale-colored or white, and resemble those of birds in shape. But the egg of the gopher tortoise is remarkable for its complete roundness. It might well be mistaken for a golf ball! Many snakes' eggs are soft skinned, brown as to color, and look for all the world like a number of new potatoes.

The eggs of fishes are usually small, soft, and inconspicuous. The most remarkable point about them is the extraordinary number laid by the individual. A single cod for example lays as many as nine million eggs. But a striking exception to this piscine rule of numerous inconspicuous eggs is seen among the sharks and their allies. These "tigers of the sea" lay eggs which are large in size, few as to numbers, and deposited singly instead of in masses. These eggs, of which several examples are shown in the accompanying photos, are known to fisherfolk by such names as "pixy purses," "fairy purses," or "mermaid's purses." They consist of a dark-colored, leathery envelope, and are usually adorned with frills, horns, or long twisted tendrils. These appendages serve the purpose of keeping the egg case supported among the branches of seaweeds, thus preserving the embryo from the damage it would sustain were the "purse" carried hither and thither by the waves.

Amphibians—frogs, newts, and the like—lay fish-like eggs without exception. The Surinam toad, however, has a remarkable way of dealing with the eggs when they are laid. The male takes the eggs one by one, and imbeds them in the soft skin of the female's back, each egg in a separate cell. Here the eggs remain being carried about by the female until the young toads hatch. There may be as many as one hundred and twenty cells in the back of a single individual, although from sixty to seventy is the more common number.

The egg laying habits of the "midwife" frog of Europe are almost equally curious. The eggs are deposited by the female in the form of long chains which may be upward of a yard and a half in length. These chains are taken by the male and wound around his legs and

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(Concluded from page 269)

thighs. Thus equipped, he retires to a hole in the bank of the stream, where he remains in concealment until the tadpoles are on the point of hatching. Then he enters the water, when his off-spring emerge from the eggs, and wriggle away to take care of themselves.

On the seashore, after rough weather, may often be seen an object which bears no small resemblance to a cluster of purple grapes. This is a mass of cuttle-fish eggs—that strange, eight-armed mollusk which disports itself in the waves to the undoing of such marine creatures as are unlucky enough to come within grasp of its suckers. Each "sea grape" is produced with a flexible stalk, by means of which it is joined to its fellows, the whole mass being fixed to some stationary object, such as a rock or stone But like the eggs of so many marine creatures, the eggs of the cuttle are at the mercy of the elements, and in times of tempest they are often torn from their moorings, and cast bruised or broken upon the shore.

Near relatives of the cuttle are snails and shellfish of many kinds, and among this great group of animals' eggs so many strange forms are found that a description of them would fill a bulky volume Many of the large land snails produce hard-shelled eggs, differing little in appearance from those of birds. An example is the West Indian *Bulimus*, shown in the annexed photograph, together with its white, elongated egg But the egg cluster of the common whelk (*Buccinum*) is like a rather dingy honeycomb, partially squeezed between the hands. When the eggs are alive and healthy, the form of the young whelks can plainly be seen through the semi-transparent substance which envelops them. Another quaint form of molluscan egg is that produced by the turret shellfish (*Turretella*) The eggs are joined together like a number of small beads on a flexible cord

If the eggs of mollusks are varied in appearance, the eggs of insects are infinitely more so. Moreover, many of them are marvelously beautiful in form and embellishment This beauty is almost always hidden from the eye unaided by the microscope, for the eggs of most insects are mere specks, often less bulky than a grain of sand Who, for instance, would expect to find beauty in the egg of the house fly? Yet place several of these eggs beneath a powerful lens, and a vision of beauty greets the eye. The eggs of many butterflies and moths—mere atoms laid upon a leaf—are equally attractive In point of beauty, the egg of the moth or fly ranks far above that of the ostrich One ponders upon this strange problem without gaining enlightenment. Why this delicate lacework? Why this flower-like elegance? Above all, why adorn at all objects of such extreme minuteness? The smaller the object, the greater the care Nature seems to lavish upon it. An example of the fact is found in the case of eggs laid by the minute insects which spend their whole lives among the feathers of birds. These minute beings pass under the unsavory title of "lice" Yet their eggs, when magnified, exhibit an amusing diversity of form and a beauty quite fairy like They are among the most popular of microscopic objects.

In conclusion it may be said that certain insects deposit their eggs in clusters which bear no little resemblance to nuts or fruit Such is the case with the "rear-horses" (*Mantidæ*) and their allies. Possibly this resemblance may be of importance in protecting these eggs from the attacks of insectivorous birds and other creatures.

Comets Expected in 1910.

The present year promises to be particularly rich in comets. Four comets, those of Winnecke, Daniel, Halley, and Innes, have been or are already visible. Innes's comet, which was very bright, appeared suddenly, it will be recalled, in the midst of a recent auroral display at Johannesburg. In addition to these four, seven periodic comets are expected to return in 1910. Probably not all of these comets will be visible, because some will be unfavorably situated with respect to the sun at the time of perihelion passage. The expected comets are the following ' 1 Giacobini's comet, 1896 V It was first thought that this comet would reach its perihelion about the middle of February, but later calculations have proved that it really passed its perihelion last December It has not yet been seen and, as its position is very unfavorable, it may escape observation altogether. 2 Swift's comet, 1895 II This comet was not seen at its return in 1902, and unless its orbit has been considerably changed, the conditions for its observation will be still less favorable this year It should have passed its perihelion about the end of January, and should then have been almost exactly behind the sun 3 The second periodic comet of Tempel should reach its perihelion about February 21st unless its orbit has been greatly changed since 1904, when the comet was last seen The conditions for observing this comet in its perihelion passage this year are, how ever, very unfavorable as, like Swift's comet, it is almost behind the sun. 4. D'Arrest's comet was seen for the first time in 1897, it was expected to return in 1904, but was not observed, owing to unfavorable conditions This year, if its orbit is not changed, it will reach its perihelion in October Its position then will be very favorable for observation, so that this comet will probably be visible next summer 5 Spitaler's comet, 1890 VII escaped detection at its visits in 1897 and 1903, because of poor conditions for observation Dr Hopfer, of Trieste, has shown that the orbit of this comet has been greatly altered by perturbations caused by the influence of Jupiter between 1890 and 1903 In consequence of these perturbations, the periodic time of the comet has been increased from 6 42 years to 6 82 years The comet should pass its perihelion in October, 1910, in conditions favorable to its rediscovery 6 Faye's comet is also expected to return in the latter part of October in conditions favorable for observation. 7 Brooks's comet, 1889 V, is expected to reach its perihelion in the summer of 1911 but it will probably be discovered during the coming summer

Moving Picture Royalties.

The moving-picture industry is on a distinctly theatrical basis It has its "trust," its theaters where actors play before a camera, its scene shifters, its supernumeraries, its property men, and a whole theatrical staff more or less similar to that of the regular theater The "trust" in question was formed about a year ago by a number of manufacturers of films under the title of the Motion Pictures Patents Company Patents, chiefly those of Thomas A. Edison, were pooled, and active steps were taken to purge the moving picture theater of some of the more objectionable pictures which have brought down a hail of criticism upon the industry, to license the moving-picture theater to use the apparatus and exhibit pictures, and to control the industry in general There were many independent manufacturers who refused to pay royalties or to acknowledge the patent rights of the Motion Pictures Patents Company A suit was recently brought by the company against Carl Laemmle, a well-known manufacturer, and the Independent Moving Picture Company of America, of which he is president, as well as the Pantograph Company, to restrain the alleged further infringement of Edison patents controlled by the Motion Pictures Patents Company. Inasmuch as the patents in question had already been adjudicated and their validity upheld, an injunction was granted The hearing brought out some very interesting statistics, which will undoubtedly open the eyes of the general public

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(*Concluded from page 270*)

lic. It seems that every day some four or five million persons attend the thirteen thousand moving picture shows of the United States. The pictures which flicker on the screen before the spectators are projected by means of apparatus, the basic patents of which were taken out by Thomas A Edison These four or five million persons, therefore, unwittingly pay royalty to Mr Edison whenever they hand in their nickels or their dimes at the box office It is stated that about 1,440,000 feet of film are made by the members of the Motion Pictures Patents Company On this production a royalty of half a cent per foot is paid to Mr Edison, so that his revenue from the moving picture-loving public amounts to $7,200 per week

The action was brought by the Motion Pictures Patents Company to restrain infringement, but the defense set up was that the company violated the Sherman anti trust law The decision handed down by Judge Noyes of the United States Circuit Court was that the question at issue was patent infringement and not violation of the anti trust law, for which reason he granted the injunction

The Brennan Mono-rail Car.

A successful demonstration was given recently at New Brompton, of the Brennan mono-rail car At the trial an 80-horse power generating set was working The trials commenced with running the vehicle loaded with packing-cases, round the circular track of 105 feet radius at a speed approaching 20 miles an hour The stability of the car under these conditions was apparently all that could be wished, the vehicle canting over several degrees toward the center of the circle of track This demonstration was followed by an exhibition of the facilities afforded by such a car for unloading The vehicle was intentionally tilted over on to chocks on the right-hand side and some cases unloaded It was then righted and then tilted over toward the left side and other cases unloaded, being finally righted again, all these operations of tilting and righting being performed solely with the assistance of the gyroscope gear The next trial consisted in carrying passengers round the circular track About fifty passengers were taken at a time, and several complete circuits of the one-eighth of a mile track were made with each load During these runs we timed several rounds at speeds of between 18 and 20 miles an hour The motion on board was quite pleasant the vehicle riding very well The inward cant that the vehicle acquires when traveling on curves at high speed naturally added to rather than detracted from, the comfort of the passengers Altogether some 300 persons had an opportunity of being on the carriages under these novel conditions The demonstration which followed showed the ability of the vehicle to take sharp curves, this, however, revealing nothing more than was evident from the earlier trial toward the close of last year The carriage, with passengers on board, was then run backward and forward at as high a speed as was practicable along the straight with perfect success The slight lateral swaying under these conditions was quite easy, and free from jerks and jolts, and not at all unpleasant. The oscillation is of very small amplitude, as the controlling action of the gyroscopes quickly damps out any tendency to a larger movement.—Engineering (London).

A compound of six parts lard and one part rosin is given by the Brass World as an efficient protection for polished steelwork from rust. The two in- the mass from becoming rancid, and stirred until cold The rosin prevents the mass from becoming rancid and also acts as an air-tight film If rubbed upon a polished steel surface it effectually preserves and protects the polish.

Pennsylvania R. R.

REMINDER BULLETIN

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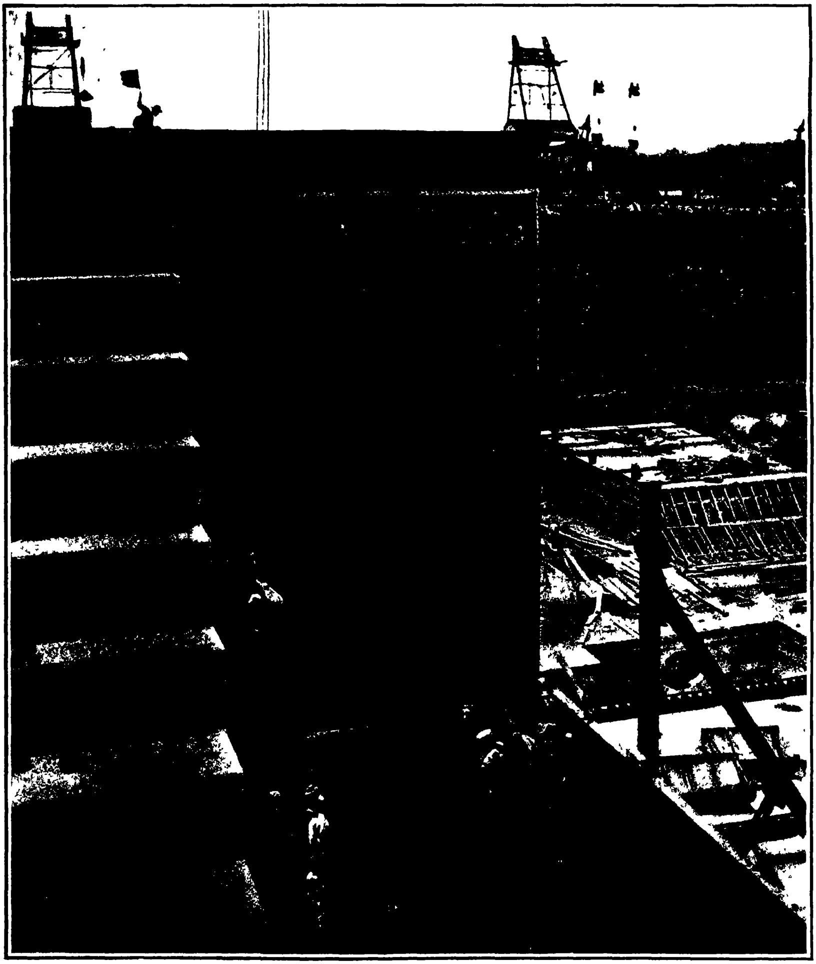

The side walls, 8000 feet long, are built in sections between plate steel forms. To the right of the completed wall is seen the interior face of a steel form with the form for the end of the section upon which the men are at work extending transversely. In the pocket thus formed the men are shoveling and tamping the wet concrete.

BUILDING THE HUGE WALLS, 50 FEET THICK AND 80 FEET HIGH, OF THE GATUN LOCKS AT PANAMA.—[See page 279.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE PANAMA CANAL AS AN INVESTMENT

CONSIDERABLE doubt is being expressed just now as to whether the Panama Canal will prove to be commercially a paying investment, and in a series of articles, which have recently been published, Admiral Evans, proceeding along several rather formidable lines of argument, is apt to leave, at the first reading, a depressing conviction that this great national undertaking can never be self-supporting.

On the other hand, there is the fact that other great canals, such as that at Suez and the one which has made Manchester a seaport, were, during their construction, the subject of similar dismal forebodings. Yet Suez has proved to be one of the most profitable commercial undertakings in the history of the world; and the Manchester enterprise, in spite of the few lean years of its earlier operation, is now accomplishing all and more than was promised.

It is well to remember, moreover, that the admiral's pessimistic view of the future is based upon a comparison of the sailing distances between certain trade centers via the two canals, and he assumes that unless the distances via Panama are shorter than those over the present routes, the new waterway will be powerless to divert existing trade from its present lines of sailing. Now although the principle as here laid down is broadly correct, it should not be forgotten that the connecting of the two great oceans is certain to materially affect the trade conditions along the whole stretch of both the Atlantic and Pacific seaboards of North and South America. Indeed, the cutting of the canal may so enlarge the trade and importance of certain of the maritime cities as to render it expedient for shipping which at present uses the Suez Canal route to take the longer route by way of the Panama Canal.

But we should judge of the value of the Panama Canal rather from the military than the commercial point of view—a fact which is well understood at Washington, where undoubtedly it acted as the compelling motive in urging Congress to undertake this stupendous work. That 14,000-mile trip of the battleship "Oregon" during the Spanish war was an object lesson, the significance of which has never been forgotten. The opening of the canal will render the whole naval force of the United States available in either ocean. In its ability to strike a rapid and decisive blow at any threatened point along the whole of the United States seaboard the efficiency of our fleet will be practically doubled, and the fact that the whole navy can in a few weeks' time be assembled in the Pacific Ocean will enormously increase the naval prestige of the United States in the Orient and must inevitably tend to preserve the peace in those great Oriental questions which begin to loom so large on the diplomatic horizon. So long as the Isthmus of Panama exists as a barrier between the Atlantic and the Pacific, we must build at least three battleships where otherwise we would build two, and the first cost of construction and the heavy cost of maintenance and operation will far exceed any temporary or even permanent deficit which may develop in the operation of the canal as a commercial venture.

Meanwhile, under the administration of that most efficient body, the Corps of Engineers of the United States Army, the execution of the work is proceeding with a rapidity which is in pleasing contrast to the confusion and disappointment which marked the earlier years of American occupancy; and in the series of striking illustrations of the work which we present in the present issue, we are enabled to give our readers an adequate impression of the magnitude and solidity of the permanent works, the most monumental concrete structures ever attempted.

RELATIVE REPAIRS ON NAVY-BUILT AND CONTRACT-BUILT SHIPS.

THE wisdom of the policy of building at least a small portion of the new ships of the navy at our leading navy yards has been and is yet a question upon which there is much division of opinion. The principal argument in favor of this policy is that it becomes possible to maintain an adequate force of skilled mechanics permanently at the yards, and avoids that disastrous breaking up of the organization and scattering of forces which occurs in the slack season when the annual repairs upon the ships are completed and they have sailed for the summer maneuvers. The maintenance of a permanent force increases efficiency and insures that the leading yards will be in a position to meet at once the heavy strain which would be thrown upon them in the event of sudden hostilities. Of equal importance to the question of the effect of new construction in maintaining a permanent force in the navy yards is that of the character of the work that they can turn out. Conclusive data upon this subject are furnished by those two sister ships the "Connecticut" and the "Louisiana," the first built at the New York navy yard, and the latter by the Newport News Shipbuilding Company. If certain disabilities under which the navy-built ship labored, due to slowness in the delivery of armor and the fact that she required special fittings as a flagship be considered, the time and cost of construction may be regarded as approximately the same as those of the ship built by contract.

As to the question of the relative quality of the work done, there is no surer test of this than the amount of repairs which have been made upon each vessel in the four years that they have been in commission. The following figures, taken from the report of the Paymaster-General of the Navy, are very conclusive on this point. In 1906, their first year of service, the repairs on the "Connecticut" cost $2,346.97, and on the "Louisiana" $5,851.09. In 1907 the repairs on the "Connecticut" amounted to $53,557.47, and on the "Louisiana" to $99,851.09, and the totals up to the end of the fiscal year 1909 were, for the navy-built ship $111,833.58, and for the contract-built vessel, $149,167.

In view of the fact that during these four years the cost of the repairs for the "Connecticut" was about 33 per cent less than that of the "Louisiana," what becomes of the oft-repeated statement that our navy yards are incapable of turning out work of the same high quality as that of our private yards?

THE NEED OF AN IMPROVED PARCELS POST

THE existing restricted parcels post system of the United States Post Office, as established by Congress in 1874, has so far limited the easy exchange of commodities and merchandise between manufacturers and consumers that it is making the United States appear to be wonderfully behind the times as compared with some foreign nations, such, for instance, as England, France, and Germany. It is a fact to-day that an American in England can send home by mail to any part of the United States a parcel weighing two and one-half times more than the United States limit for about one-third less in cost than the present home rates. In other words the world postal union package unit is eleven pounds to the parcel at the rate of twelve cents per pound. Whereas the United States unit is only four pounds to the package at a cost of sixteen cents to the pound. The parcel rate in the United States prior to and early in 1874 was eight cents per pound for a package limited to a weight of four pounds. After that the rate was doubled, but the weight remained the same. Since 1874 the cost of transportation has greatly decreased. The question is, why should not the public through its representatives in Congress be given the benefit of this decrease by the establishment of a uniform low postal rate for parcels that will encourage the use of the Post Office as a medium of exchange of commodities, and thus greatly facilitate trade?

Since the experimental introduction of the Rural Free Delivery system in this country, its operation has proved so great a necessity, convenience and success that Congress overlooks the annual deficit arising from the unreasonable restriction placed in the law limiting the kind of postal matter to be carried to letters, newspapers, and periodicals. The weight of this average load is ascertained to be but twenty-five pounds per trip, while the vehicle which the postal agent is required to supply can readily carry two hundred pounds. It is estimated that should the restriction be removed and parcels be carried, even allowing only one or two parcels per trip, enough revenue would be received from the additional postage to more than pay the total cost of this system, and make it self-supporting.

A movement in this direction is the introduction of a bill before Congress, prepared by the Postal Progress League, known as the Bennett Rural Parcel Post Bill, now in the House Postal Committee, which provides for very moderate postal local rates along rural routes between the city or town and places in the adjoining country. It would enable the merchants in the commercial center to send, say on telephone orders, small supplies directly to the purchaser living on the route, and would promote the exchange of merchandise between the residents themselves on the route, as well as their sending products to the commercial center. The service would be somewhat similar to that of the usual postal railway coach and its collection and distribution of mail matter.

With the extension of good roads and the use of rapid automobiles, a longer route could be established than now exists, as a maximum distance, which would reduce the number of vehicles required and economize the cost of maintenance.

In this connection the experience of the use of the mail automobiles in London is worthy of note. At the second annual dinner of the Royal Automobile and Associated Clubs of London in the summer of 1909, Sir Henry Norman in a speech alluded to the success of the mail automobile as a time and money saver in the transportation of mails, by saying that in the city there were thirteen local motor services averaging thirty-two miles a day. There were also ten sets of services in and out three times a day between London and the principal towns on the outskirts of the city. In the thirteen long-distance night automobile mail coach services a saving of $300,000 a year was effected as compared with the horse service which did the same work only a few months before. The London Post Office is now operating no less than sixty of these motor services.

Results of this character certainly show that the establishment of a very low postal rate for parcels is feasible, since it will create more than sufficient revenue to pay the cost, besides saving money for the merchant and consumer.

It is to be hoped that Congress will give such intelligent consideration to all matters relating to postal improvement that the system, so useful and necessary to the people, will forthwith be placed upon a sound business basis.

HYDRAULIC TURBINE REDUCTION GEAR.

IN the issue of the SCIENTIFIC AMERICAN of February 12th of the present year, we described the turbine reduction gear designed by McFarland and McAlpine, in which a mechanical gearing is interposed on the shafting between the turbine and the propeller, for the purpose of reducing the economical high speed of the former to the relatively low economical speed of the latter, and it was noted that a mechanical efficiency of 98.5 per cent had been secured in the shop tests. Simultaneously with the development of this gear, the problem was attacked by Dr. H. Föttinger, who, with the assistance of the Vulcan Works at Stettin, has produced a reduction gear which substitutes for the toothed gear of the McFarland system a set of hydraulic turbines through which a body of water is kept in constant circulation, and by the proper proportioning of whose buckets and channelways the desired reduction of speed is secured. A complete description of this gear with illustrations is given in the current issue of the SUPPLEMENT, to which reference is made for fuller details than are here given. The turbine shaft and propeller shaft are independent. Upon the former is mounted a rotary pump, which delivers its water into the buckets of a water wheel which is mounted rigidly upon the propeller shaft, and it will be evident that by selecting the proper relative dimensions of the two members, the desired ratio of speed between turbine and propeller can be obtained. In its simplest form the reduction gear consists of a pump, guide channels, and a driven water wheel, but in the larger powers one or more intermediate wheels would be interposed between the pump and the driven wheel, indeed transformers with one or more stages are preferable when a considerable reduction of speed is desired. With a reduction ratio of between 1 to 4 and 1 to 6, using two reduction stages, an efficiency of from 80 to 82 per cent is secured. This seems low when compared with the 98.5 per cent efficiency of the McFarland gear, but the German system has the advantage that it is readily reversible. The system has been tried on a small vessel of 76.7 tons, which has been driven by a 500-horse-power turbine at a speed of between 12 and 13 knots. When the reversing lever was thrown over at full speed, the propeller shaft came to a standstill in 5 seconds, and within 15 seconds had acquired a reversed speed of between 200 and 250 revolutions. On the whole, it would seem that the German, because of its low efficiency, cannot compete with the American system on ships that make long continuous voyages. On channel and river steamers and for tugs and small vessels it has some advantages.

Asbestine, for Fireproof Coatings.—Prepare a paste-like mass of asbestos, powdered silica, caustic potash, and soda-water glass. To be burned and sand mixed with it.

ENGINEERING.

[illegible]-atlantic record has been broken, this time by the "Mauretania," which reduced the long Atlantic course of 2,889 miles by 26 minutes, making the passage from Daunt's Rock to the Ambrose Channel Lightship in 4 days, 15 hours, and 29 minutes, at an average speed of 25 91 knots.

The great value of the steel car as a protection to passengers in the event of collision was demonstrated in a recent clash of two trains in the Hudson tunnels. There was no such telescoping as would probably have occurred with wooden cars, and the injuries were merely such as resulted from the passengers being thrown down by the shock of the collision.

A recent issue of Cassier's, states editorially that the first British steamboat was not Bell's "Comet," which ran on the Clyde in 1811, but the "Accommodation," which commenced running between Quebec and Montreal on the St. Lawrence River on November 5th, 1809, or two years after the "Clermont" made her initial run from New York to Albany The first steamers on the Lakes were the "Ontario" and the "Frontenac," which appeared in 1816

A French naval constructor, basing his deductions on the recent French maneuvers, believes that the future submarine will be a "submersible destroyer" of [illegible] knots surface and 15 knots submerged speed, of sufficient radius of action to accompany the main fleet on long cruises. He believes that the greater the radius of action and the higher the submerged speed, the nearer will such a vessel approximate a perfect underwater instrument of offense and defense

Some tests of the effect of superheating recently made on the American yacht "Idalia' show striking results. When using saturated steam, the consumption of water per indicated horse-power was 18 3 pounds. This was reduced to 17 pounds, with 57 degrees of superheat, 15 8 pounds, with 96 degrees, and to 15.5 pounds, with steam at 105 degrees superheat, this last being a saving of 15 3 per cent of steam, a truly remarkable showing The trial with saturated steam was of two and one-quarter hours duration, and with 105 degrees the test lasted for three hours.

A report of the Public Service Commission, relating to the delays of passenger trains in New York State during December, shows that 60,385 trains were run, of which 75 per cent were on time at division terminals. The average delay for each train was 39 7 minutes, and the proportional causes of delay were Waiting for trains on other divisions, 40 9 per cent, waiting for train connections with other roads, 14 4 per cent, train work at stations, 12 2 per cent, trains ahead, 8 per cent, meeting and passing trains, 4 8 per cent, engine failures, 4 3 per cent, train wrecks, 3 8 per cent.

An experiment which is being tried on the Hudson and Manhattan Railroad tunnel system beneath the Hudson River will be watched with much interest by both the railroads and the public It consists in illuminated station signs, placed inside the cars, which are so arranged that the guard by pressing a button when the train starts, rings a bell and causes the sign to display the name of the next station This sign continues to be displayed until the train leaves the station designated A simple device this, whose utility is so obvious, that it should have been in use from the very commencement of electrically-operated rapid transit.

A commission of engineers and scientists is making an exhaustive study of the causes of the recent flood in Paris, preparatory to devising a system of protective works which will absolutely prevent any recurrence of the disaster The main work of the commission will be to devise a plan for keeping the river Seine within its banks either by the construction of higher embankments or by the provision of a by-pass channel to carry the surplus waters around the city At the same time the commission will investigate the various public services, including surface and subway lines and the sewer, gas, electricity telegraph, and telephone systems which were affected by the inundation, with the object of remedying the defects which were developed during the flood

The work of providing adequate coast fortifications has been carried to the point at which they may now be considered to be very complete, at least as far as the guns and emplacements are concerned. The full efficiency of these fortifications cannot be realized, however, because of the lack of proper submarine mine equipment and the proper accessories for the mines and guns already installed, such as fire control apparatus, searchlights, power plants, and adequate ammunition. The Chief of Coast Artillery says: "Without these accessories the $70,000,000 already expended would be wasted, since the guns would be of no more value in the defense of the forts in which they are mounted than so many dummies." To make this provision will require about [illegible].

ELECTRICITY.

As the Glidden tour this year will pass through territory where the telephone and telegraph service is very poor, it has been decided to equip the cars with wireless telegraph apparatus. This will make it possible to keep in close touch with the contestants, and the latter will be able to report accidents and call for help when necessary

In plants which use a gas engine to drive their generators the variations in speed of the engines are not noticeable if carbon filament lamps are used, because the filament is quite thick and does not respond quickly enough to show any fluctuations in light With tungsten filaments the light waverings are very annoying, and gas-engine manufacturers have found it necessary to equip their engines with heavier flywheels

A convenient method of determining variations in the candle-power of a lamp was described in a recent number of Elektrotechnische Zeitschrift. A selenium cell is employed, which is exposed to the lamp under test and is placed in series with a recording milliammeter The curve recorded by the milliammeter, which is due to the variable resistances of the selenium cell, indicates the variation of the candle-power of the lamp To be sure, this does not give an accurate photometric measurement.

A large section of land has been bought by the Commonwealth Edison Company in the northwestern part of Chicago, where two large generating stations are to be built Each station will be equipped with six turbines and in the first station the capacity of each turbine will be 30 000 horse-power It is expected that within two years 60,000 horse-power will be in operation These stations are made necessary by the fact that the output of the company has doubled every three years for the last twelve years

Chicago is trying a new car designed to remove city garbage over the street railways at night The car is of steel construction, 34 feet long divided into three sections which are so shaped that they can be dumped with a pole by a single man thus doing away with the necessity of using air cylinders or other mechanical dumping apparatus The sections are made watertight, so that there will be no leakage of wet garbage The car is not provided with motors It is intended to use the car in the daytime for hauling concrete and construction materials

A novel method of recovering a sunken cargo has been adopted by the United States Steel Company A large magnet, 3½ feet in diameter and weighing 3 000 pounds, has been employed in raising kegs of nails from a barge that was sunk in the Mississippi River near New Orleans The magnet raised five or six kegs at a time, or about a ton at each lift The advantage of this method was that it avoided breaking open the kegs as would have been the case had a dredge been used The magnet is soon to be used for raising a sunken load of woven wire, and also for a load of steel baling strips

Several years ago the Illinois traction system decided to use sleeping cars between Springfield and East St Louis As this system has proved a success, several more cars have been ordered for use between St. Louis and Peoria. These cars will differ from the first ones in having no motor equipment They will be trailers and it is expected that a good deal of the annoying vibration of the first cars will thus be overcome The cars will be 54 feet long and will be provided with ten upper and ten lower berths It is believed that this system may compete with through steam railroad service, for the reason that at night one does not care how fast he travels provided he can sleep comfortably and find himself at his destination when he wakes up in the morning

The following subjects will be taken up at the International Congress of Telephone and Telegraph Engineers, which is to meet at Paris this year (1) Manual versus automatic systems of telephone working (2) (a) Simplification of telephone circuits, (b) selection of frequency and secondary potential (for purposes of theoretical investigation) with a view to facilitating the approach of the telephone current to the sine wave-form, (c) the circumstances conditioning the adaptability of telephone apparatus to the lines, induction coils, microphone resistance, etc (3) Precautions to be taken for the avoidance of mutual disturbance in the case of power circuits running in close proximity to telegraph and telephone lines. (4) Telephony between places at great distances from each other Construction of cables for long-distance use relays, combination of aerial lines with cables. (5) Wooden poles—new process for impregnation and preservation—and procedure described from actual practice as to staying and strutting. (6) Party lines and selective calling upon telegraph and telephone lines. (7) Telegraph systems for heavy traffic Multiple type-printing telegraphs and the Mercadier system.

SCIENCE.

Mr. H. H. Clayton, late of the Blue Hill Observatory, has gone to Buenos Ayres to organize kite and balloon observations under the direction of the Argentine Meteorological Service

Knut Angström, professor of physics at the University of Upsala, died March 4th He was distinguished as an investigator of solar radiation, and devised the instrument adopted by international agreement as the standard for measuring this element, viz., the Angström electric compensation pyrheliometer

The International Meteorological Committee, which assembles triennially, will hold its next sessions in Berlin during the last week of September 1910 Dr W N Shaw, director of the British Meteorological Office, is president of the committee and Prof Dr G Hellmann, director of the Royal Prussian Meteorological Institute secretary

The standard troy pound of the Philadelphia Mint was recently tested by the Bureau of Standards and found to be slightly over weight, because of the accumulation of oxide on the surface The test was certified to by the bureau officials in a report to the Director of the Mint It was shown that when the weighing took place the temperature of the air was 22 deg C, the relative humidity was 60 per cent, the barometer was 754 millimeters the mean density of standards was 8 42 at 22 deg C The weight variation of the troy pound was determined to be 0 007 of a grain This variation is what is called by scientists "tolerance,' and is negligible In the coining of $100,000,000 the government would lose just $121 53 as a result of the slight overweight

The Flora bust controversy will not die Dr George Pinkus the well-known German chemist analyzed the wax in the famous bust and found it to be a combination of lac, spermaceti and beeswax Alleging that spermaceti was unknown until 1700, he argues that the bust could not have been Da Vinci's Furthermore, he proved that the composition is identical with that used by Lucas the sculptor who is said to have made the bust Dr Bode still maintains that the bust is a genuine Da Vinci He replies that Prof Rathgen made several analyses and found that the wax of the bust was different from that used by Lucas In Dr Bode's opinion Dr Pinkus analyzed only part of the outer layer of the wax which Lucas added Moreover, Dr Bode quotes Prof Lippmann of Halle University as authority for the statement that the peculiar wax in the bust was abundantly employed in Mediterranean countries at the beginning of the sixteenth century despite the belief in some quarters that it was not known until 1700

At the invitation of the Rochester Chamber of Commerce and the Civic Improvement Committee of that city the conference of 1910 will be held at Rochester May 2nd to 4th American cities are being aroused to the necessity for a city plan, and for the prevention of congestion of population Many cities have plans others are getting them a few are following them out Why it is imperative to adopt a city plan is becoming secondary in practical importance to how the city plan once adopted can best be carried out. The purpose of the conference this year is not primarily to continue the campaign of education nor to increase the literature which makes up the already weighty argument for the necessity of planning American cities but the conference is a gathering of experts called because of their intimate knowledge of a specific subject to make a concrete contribution to the science of city planning Generalities will be most carefully avoided The aim will be to discuss phases of each selected subject thoroughly rather than to wander through the whole field

Prof. Pierre Roveda, an architect of Buenos Ayres has devised a special plan for the construction of whole districts of houses for the working classes Instead of employing the usual square block as a unit, Prof Roveda adopts a circle varying in diameter from 100 to 130 yards This circle of ground is subdivided into 99 radial lots converging to a center The circle is concentrically divided to form an interior avenue four yards broad to permit of communication with the center of the circle Each avenue leads to external sidewalks and to longitudinal and transverse streets In the center of the circle is a plot of 40 yards in diameter where children may be left to themselves without their parents' care, in charge of a specially designated person In this garden a playroom a school, a hospital, a fire station, and an administration room are to be found Naturally this circular plot of ground will leave four corners free In each of these corners Prof Roveda intends to erect four chalets, such as grocery shops dairies barber dashers and the like, which are to be conducted on a co-operative plan In each of the 99 radial plots a workingman's house is to be built on the English plan. It is argued that the circular arrangement will give continuous sunshine at all hours of the day and plenty of light and air.

A NEW TYPE OF TORPEDO BOAT

A DOUBLE-HULLED BOAT WITH ITS ENGINES ENTIRELY BELOW THE WATERLINE

A new type of war vessel provided for by Congress in the Naval Appropriation Act of last year will be officially tested by the United States government at Boston within a few days. It is known as the subsurface torpedo boat and is designed to be immune from the small gun fire now relied upon as a protection against ordinary torpedo boats. It consists of a submarine hull which contains all the machinery and torpedo armament suspended from an unsinkable surface hull divided into compartments packed with cellulose. Last year's law authorizes the purchase of this boat when the official trial shows that it fills requirements and the construction under contract of two others of the same type. The boat has had a preliminary trial. Tams Lemoine & Crane, the consulting architects, report that it easily made 18 knots per hour, thus exceeding the required speed by 2 knots.

Six tons is the weight of the vessel and its length is 46 feet. The price which the government has agreed to pay is $22,500. The small subsurface boats can either be used for coast defense or they can be carried on board of the larger vessels in an armored fleet. In time of action they can be launched and directed by day or night against the enemy's fleet, particularly for operations against ships lying under the protection of land fortifications or mine fields where expensive battleships should not be risked as they were at Manila, Santiago and Port Arthur.

In the submarine hull of the new style boat is an eight-cylinder gasoline engine of 150 horse-power. The explosive charge carried for use on hostile vessels is 1,000 pounds of guncotton. An armored conning tower on the surface hull communicating with the submarine hull enables the navigator to direct and control the boat's movements. Only two men are required on board.

It is estimated that a fleet of fifty of these subsurface torpedo boats will cost about as much as two or three destroyers or submarines. As their cruising radius is 200 miles their principal function will probably be for the defense of ports and unguarded coast line.

The subsurface boat is to be operated in one of two ways. Either it may be steered within short torpedo range and aimed at its objective, the crew leaving it in lifeboats or buoys, or it may be fitted with a submerged bow torpedo tube to discharge the ordinary 18-inch torpedo.

For the firing of the high explosive use is made of an electrical firing circuit which is actuated by a bow firing pin but which is kept open and safe by a switch in the conning tower until the boat is deserted. It is also proposed to continue the firing circuit around the inner skin of the upper hull below the water line so as to explode the charge if the boat should be rammed, and thus deter hostile boats from ramming. Also it is proposed to use on the engine sparking circuit a time switch which will automatically break the sparking circuit and stop the engine and boat if it misses its objective.

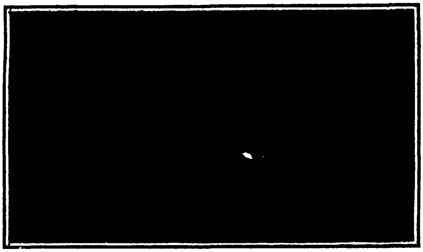
The total government appropriation for boats of this type is $445,000. When the first is approved the Navy Department is authorized to contract for two others, one more of the same size and one larger and faster—a $400,000 subsurface seagoing destroyer.

A year or two ago the Assistant Secretary of the Navy recommended the building of a number of small motor torpedo boats of approximately the same size as this to be laid up on shore in peace time for occasional practice runs by the naval reserve and for use by them in case of hostilities. The boats proposed were to be of 17½ knots speed, which is somewhat less than has been achieved by the present subsurface boat on its preliminary trials.

The English motor torpedo boats built by Yarrow with Napier engines make about 18 knots. They are of about the same size as the vessel we are describing and are used for the same purposes. It would appear therefore that no speed has been lost by carrying the engines and torpedo below instead of within the hull of the boat. It is suggested that in view of the comparatively small expense several flotillas of these boats could be distributed along our coasts and laid up with the engines greased, in which condition the expenses of maintenance would be very small.

There can be no doubt that all the navies of the world are just now directing special attention to subsurface warfare and the trials of this boat, which offers some decidedly valuable features in the great protection afforded both to the motive power and the high explosive, will be watched with no little interest.

The general design of this very interesting craft is due to Clarence L. Burger, C.E., of New York, and the plans, calculations, etc., were made by the Naval Architects Tams, Lemoine & Crane.



THE SUBSURFACE TORPEDO BOAT ON ITS TRIAL TRIP

The Oldest Attic Letter

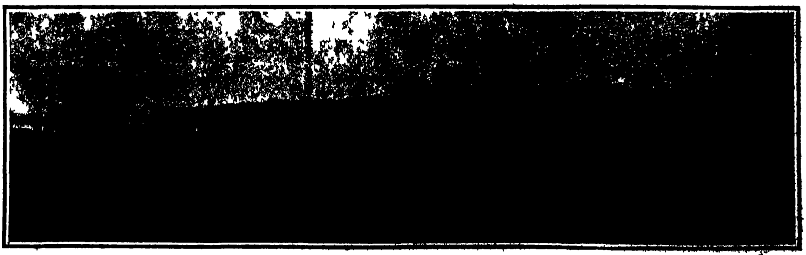
A little leaden tablet tarnished ugly and otherwise trivial in appearance was sent a few years ago from Athens to the Imperial Museum of Berlin. On one side of it is some writing which only recently was deciphered with precise correctness by Adolph Wilhelm, an Austrian *savant* who lives in Athens. The tablet is the original of a private letter that was written about the time of the orator Demosthenes.

The writer of the letter lived in a rural neighborhood and wished to send a commercial order to a town. The form of the address was: "To be taken to the pottery market and to be handed to Nausias, or Thrasykles, or to the son" (perhaps the son of the writer was meant). The weekly market, to which the Attic countrymen had gone to offer their produce and wares for sale, may be imagined as in progress. There the boy who was bearer of the letter was to find the stand or booth of one of the three persons to whom it was addressed and deliver it to him. The text of the letter says: "Mnesiergos greets you cordially. He greets your family with the same esteem and wishes them good health, and he says also that his own health is good. Please be so kind as to send me a mantle, either of sheepskin or of goatskin, and let it be as cheap as possible, for it does not need to be trimmed with fur. Send with it a pair of heavy soles also. As soon as I have an opportunity I will pay you."

So much for the letter, to the motive of which the reader can point with as much precision as the author. Apparently it was written in winter, poor Mnesiergos having been surprised out in the open country by one of those icy snowstorms which sometimes even at this day cover the temples of the Acropolis with a mantle of snow. Therefore he desired to receive as quickly as possible the heavy and warm garment of the poorer countrymen, a goatskin, which could be bought for four and a half drachmas, and the strong soles which were worn under the ordinary sandals on the rural plains and hillsides. A good pair of the latter could be bought for four drachmas, as a well preserved bill of that date shows.

A noteworthy feature of this artless letter is the formula with which it begins, the very formula that may be found used in very numerous letters that were preserved by the Greek literature of later times. Even at the present day every letter written by a rural Greek begins with the same cordial inquiry about the health of the person to whom the letter is written and with brief information about the health of the writer.

Although it is possible to resolve into gas almost any kind of solid fuel in a gas producer, it is well known that certain fuels—particularly those high in ash and of a caking character—give a good deal of trouble. One of the most serious of these troubles, states a contemporary, is that the fuel welds itself into a large mass which partially chokes the fire in some places and causes passages or holes to be burnt at others. Hence poking of the fire is necessary, and the poorer the fuel the more the poking. In order to reduce this poking to a minimum some producer makers fit shaking or revolving grates. The latest design of this character is due to Mr. Chapman, an American, and it is a considerable extension of the principle. The lower portion of the producer is divided into two or three rings which are free of each other and rotate at different speeds, the joints between them being made by water seals. The object is to shake the fuel continuously so that caking or clogging and holes are equally impossible.



This little craft, 46 feet 9 inches long, carries its war head and engines in a suspended cigar-shaped hull which lies entirely below the waterline and therefore out of reach of the enemy's projectiles. The upper hull, being filled with cellulose, is designed to be unsinkable. In attacking, the boat would be driven at the enemy at its full speed of 18 knots, and when it was within striking distance the crew of two men would jump overboard, lashing the rudder and leaving the boat to explode its charge of 1,100 pounds of guncotton by bodily ramming the ship.

NEW TYPE OF DESTROYER FOR THE NAVY.

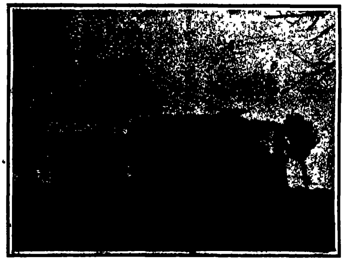
TRACKLESS ELECTRIC TROLLEY-DRAWN SLEIGH IN NORWAY

BY FRANK C. PERKINS

The accompanying illustration shows a novel sleigh trailer in Drammen service during the past winter in Norway as drawn by the trackless electric trolley.

The novel construction of the trackless trolley car of the A. S. Drammens Elektriske Bane is shown in the illustration as placed in operation by the Gesellschaft fuer Gleislose Bahnen Schiemann of Wurzen in Saxony, Germany. There are two overhead conductors provided along the Drammen River over the roadway for a distance of 3.5 kilometers (2.18 miles). The city of Drammen has about 25,000 inhabitants, who are served by this electric trackless trolley line. There are four motor cars in service, which have run 125,000 car kilometers (77,671 car miles) during the past year.

A direct current of 5,000 volts is used on the overhead trolley line, this current being supplied from a substation equipped with motor generators and step-down transformers. The current is generated at a hydro-electric power plant 40 kilometers (24.85 miles) away and transmitted to the sub-station at an alternating current of high voltage. The alternating current is transformed to a direct current by a converter of 60 kilowatts capacity. The cars weigh about 3,000 kilogrammes (6,614 pounds) each and are provided with rubber-tired wheels. An electric motor of from 15 to 22 horse-power capacity is utilized, which drives the trackless trolley car at a normal speed of about 20 kilometers (12.43 miles) per hour. The cars are lighted with five tantalum incandescent lamps of 32 candle-power each. It will be noted that the trolley pole is similar to those of American construction, but provided with two conductors and contacts of the sliding type for both trolley wires instead of the usual single trolley wheel used on electric railways.



A PASSENGER SLEIGH DRAWN BY A TRACKLESS ELECTRIC TROLLEY

Every winter the demand for fresh eggs becomes more insistent and more difficult to supply. Poultry breeders in different parts of the world have endeavored to supply the deficiency by artificial selection. By this process an Australian breed of fowls which averages 270 eggs per hen per year has already been produced. A series of very interesting experiments on the same subject has been carried on during the past ten years at Macdonald College, in Montreal, which is reputed to be the most perfectly equipped school of agriculture in America. Starting with breeds noted for their endurance of cold, especially Plymouth Rocks and White Wyandottes the experimenters began the process of selection by allowing the fowls to leave the poultry yard and scratch in the snow in the coldest weather. The progeny of the fowls which availed themselves of this privilege was subjected to similar treatment which was continued for several generations. The poultry houses were not heated, even when the temperature fell to zero Fahrenheit, although the fowls were slightly protected from the cold by screens placed around their perches. The poultry yards were covered with a layer of straw a foot thick, upon which wheat or millet, the only food given, was strewn at regular hours. The hens were kept busy from morning until night in hunting for their food in the straw. This active exercise prevented the accumulation of fat and stimulated the production of eggs, for every poultry farmer knows that fat hens are poor layers. Hence, as hens, like all other birds, naturally store up fat at the approach of winter, the problem became limited to preventing this accumulation of fat, and at the same time assuring to the hens an abundance of food. The problem appears to be in a fair way of solution for the hens of Macdonald College produce an average of 200 eggs per year, from one-fifth to one-fourth of which are laid during the rigors of the Canadian winter.

The removal of ashes by conveying them to a waste bank hydraulically is done in connection with the temporary plant built to supply power during the construction of the Rainbow Falls hydro-electric development of the Great Falls Water Power and Townsite Company on the Missouri River near Great Falls Mont. The power house is on the side of a hill directly above the edge of the river bank. The bituminous coal used is dumped by gravity from cars on a trestle to a bin at the rear of the firing floor of the boiler room and runs down on this floor, from which it is fed by hand to the furnaces. As the ashes fall through the grate they are drawn out into a transverse concrete lined trench in the firing floor. This trench is sloped to one side of the building, where it connects with a flume extending on a grade of about 5 per cent to the edge of the river bank. When the grates are cleaned the ashes are pulled into the trench and a hose stream turned into the latter to start them. They are thus picked up by and carried out in the river through the flume. No difficulty is experienced from clogging in the trench or flume and the current in the river prevents an accumulation at the edge of the bank.

THE EARLIEST STORY OF THE DELUGE

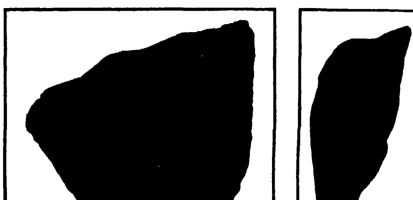
PROF. HILPRECHT'S REMARKABLE DISCOVERY

One of the most remarkable discoveries which has ever been made in Assyriology, a discovery which redounds greatly to the credit of the University of Pennsylvania and to the credit of Prof H C Hilprecht, is the finding of an account of the Babylonian Deluge which antedates any Deluge narrative extant. The significance of the discovery is enhanced by the fact that in the most important details it agrees remarkably with the Biblical version of the Deluge, much more so in fact than any other cuneiform version thus far unearthed.

The work of Prof Hilprecht is of fundamental importance for the correct determination of the age of Israel's earliest traditions, for the Nippur tablet, upon which the story is written, was inscribed before Abraham had left his home in Ur of the Chaldees.

Upon Prof. Hilprecht's recommendation that his discoveries be made accessible to the scientific world as quickly as possible, a paper by him has recently been published by the University of Pennsylvania, which bears the title, "The Babylonian Expedition of the University of Pennsylvania. Series D: Researches and Treatises. Vol. V Fasciculus." From this paper the following abstract is made:

Toward the end of October, 1909, while unpacking and examining two boxes of cuneiform tablets from the fourth expedition of the University of Pennsylvania to Nippur, Prof. Hilprecht's attention was attracted by some fragments which presented certain peculiarities, and which, unlike the others in the boxes, were not written in Sumerian, the ancient sacred language of Babylonia, but in the Semitic dialect of the country. This fragment was so completely covered with crystals of niter and other sediments that, when taken out from its paper wrapper, at first only a few cuneiform signs could be recognized. Three characters in particular, standing together in the upper section of the fragment, were fortunately free from incrustations. The words were *a-bu-bi* "deluge." Prof Hilprecht's attention was naturally aroused. For three continuous weeks he personally spent from one to two hours every day endeavoring to uncover one cuneiform character after another by removing the incrustations and other deposits of hardened dirt without damaging the writing below, until he had completely deciphered every sign. The fragment proved to be a somewhat incomplete but unmistakable account of the Deluge about 1500 years older than similar fragments obtained from the library of Ashurbanapal (668-626 B C) and was inscribed more than 600 years before the time generally assigned to Moses, and even before the Patriarch Abraham rescued Lot from the hands of Amraphel of Shimar and Chedorlaomer of Elam (Genesis 14). Furthermore in its preserved portion it showed a much greater resemblance to the Biblical Deluge story than any other fragment yet published.



FRONT AND EDGE VIEWS OF THE NIPPUR VERSION OF THE DELUGE. DATE, APPROXIMATELY, 2100 B. C.

The cuneiform text of the fragment contains a portion of the divine command to the Babylonian Noah, Ut na pishtim to construct a ship and to save life from the all destroying flood. Apart from the tradition of a great flood handed down by the Babylonian priest Berosus (living between 330 and 250 B C) but preserved only in extracts by other ancient writers there are fragments of three distinct Deluge versions in cuneiform writing.

The first of these is the version from the library of King Ashurbanapal (668-626 B C) which was restored from a number of fragments found in the ruins of Nineveh, and which is an Assyrian copy of a Babylonian original.

The second is a somewhat different version of the Babylonian Deluge story and is found on Fragment "D(aily) T(elegraph) 42," which likewise came from the royal library of Nineveh and was inscribed about the same time (c 650 B C).

The third fragment is that acquired and published by Prof Scheil of Paris, and now in the possession of Mr J Pierpont Morgan. It is dated "In the year when King Ammi-zaduga built Dur-Ammi zaduga at the mouth of the Euphrates," i e, the eleventh year of his government, in other words, according to Prof Hilprecht's reduced chronology, about 1868 B. C.

An examination of the cuneiform text of the Nippur fragment and a comparison of this new version of

the Babylonian Deluge story with the parallel passages of the two Nineveh versions and the Biblical story have brought out the significant fact that, with all due allowance for a general resemblance between the three cuneiform versions, the Nippur version of the divine announcement of a great flood and the command to build the ark differs fundamentally from the two Nineveh versions and agrees most remarkably with the Biblical story This agreement affects that part of the Pentateuch (Gen 6 13-20 8 11) which Old Testament critics style P (=Priestly Code) and generally regard as having been "compiled in Babylonia about 500 B C" The importance of this new text to theological students cannot be overrated Written as it was about 2100 B C, this new version came into being at a time when the sanctuary of Enlil at Nippur was supreme among the Babylonian temples and was the center of literature When Hammurabi, the Amraphel of Genesis 14 conquered Rim-Sin of Larsa, the various petty Babylonian states constituting geographically the ancient kingdom of Shumer and Akkad were united politically by the conqueror Babylon on the Euphrates became the metropolis of the united empire After Ammi-ditana the third successor of Hammurabi Nippur disappears rapidly from history It reappears with the rise of the Cassite dynasty in Babylonia about 1400 B C, and its sanctuary again rises to hold a conspicuous place for several centuries The revival is but the last flicker of a fast dying flame

In Prof Hilprecht's opinion the Temple Library at Nippur was a most insignificant institution after 1000 B C, and it flourished most gloriously before 2000 B C The priests of the Cassite and Neo-Babylonian periods produced few, if any original literary compositions of value at Nippur more delighting in the statement at the end of their tablets that the text was "a faithful copy of an old Nippur original' The literary activity of the priests was transferred to other centers like Babylon and Sippar It is therefore evident that the Nippur fragments, antedating the two Nineveh versions by 1500 years, represent the oldest version of the Babylonian Deluge story in a Semitic translation, made doubtless from a much older Sumerian original which has not yet been discovered and that the later cuneiform versions are different editions of the same story with considerable changes, abbreviations, and additions The Deluge story of the so-called "Priestly Code" must form part of the oldest traditions of Israel as Old Testament scholars have pointed out

Even the Amarna period (about 1400 B C) with its unsettled conditions in Palestine, when the influence of Babylonia upon the shaping of the government and the religious conceptions of Palestine was almost nil cannot explain its presence in the Old Testament. The only period when the oldest version of the Deluge story could possibly have entered Canaan was the time when Abraham, whom Prof Hilprecht regards as an historical personage, left his home on the Euphrates and journeyed westward, in other words, the period of the first dynasties of Isin and Babylon of which Hammurabi or Amraphel is the central figure, the time when the Amorites knocked at the gates of Babylonia, invaded the country, and soon overthrew the old dominion

Although the interpretation of the Nippur tablet is by no means easy it can be stated with safety that in accordance with the exalted position held by Enlil in the old Babylonian pantheon as "father of the gods" it was in all probability Enlil himself who warned Ut-na-pishtim to take refuge in an ark Here then as in the Biblical version, the Lord of the Universe himself both causes the Deluge and saves Noah from destruction by warning him and ordering the construction of an ark

We present herewith in parallel columns the translation of the actual preserved portions of the ancient Nippur version and the corresponding passages of the Old Testament according to the Hebrew text. The similarity is at once striking so much so in fact that the blanks in the Nippur version can easily be supplied by the more complete account

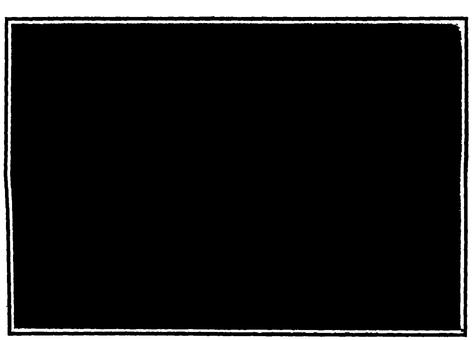
Line	Nippur Version.	Biblical Version (Gen 6 13-20 7 11)
2	I will loose."	7 11: "all the fountains of the great deep were broken up, and the windows of heaven were opened."
3	'it shall sweep (or 'take') away all men together"	6, 11 "behold, I will destroy them with the earth."
4	life (?) before the deluge cometh forth"	18 "but with thee I will establish my covenant"
5	(over) 'as many as there are, I will bring overthrow, destruction annihilation	17 and behold I do bring the deluge upon the earth to destroy all flesh, wherein is the breath of life, from under heaven, every thing that is on earth shall perish
6	'build a great ship and"	14 'make thee an ark. '
7	'total height shall be its structure"	15 'and thus thou shalt make it and thirty cubits its height"
8	'it shall be a house-boat carrying what has been saved of life'	16 A roof shalt thou make to the ark, in its (entire) length thou shalt cover it and the door of the ark shalt thou set in the side thereof (with) lower, second and third stories shalt thou make it'
9	'with a strong roof over it	
10	(the boat) 'which thou shalt make'	19 And from every living thing from all flesh two from everything shalt thou bring into the ark, to keep them alive with thee, they shall be male and female"
11	'instead of a number"	20 (two) from the birds instead of a number thereof, (two) from the beasts instead of a number thereof (two) from everything creeping on the ground instead of a number thereof."
12	and family"	18, b 'and thou shalt come into the ark, thou and thy sons, and thy wife, and thy sons wives with thee.'

The Current Supplement.

The current SUPPLEMENT, No 1787, contains a most remarkable number of interesting articles. Karlernst Knatz writes on the modern use of police dogs, and R W Raymond on quantitative and qualitative thinking. Prof R S Woodworth deals interestingly with the 'typical' man a creature who does not exist, but yet who is very necessary in the endeavor to classify mankind A prominent place among the physical agents employed in modern methods of therapeutics has been occupied for the past decade by light and especially by electric light, which is used chiefly in the form of "light baths" and is furnished by arc and incandescent lamps separately or in combination Dr Theodor Schueler reviews these modern therapeutic agents in an article entitled 'Electricity and Light in Modern Medicine' No name is more distinguished among modern astronomers than that of Prof G E. Hale, the foremost authority in the world on the sun He contributes a brilliant article on solar vortices and magnetic fields, in which he critically discusses recent solar investigations, and particularly his own wonderful discovery of the Zeeman effect in sun-spots In scientific research, as in less ambitious affairs, the possession of a good imagination is often of the utmost value There are few instances in which a closely reasoned sequence of ideas has been employed in the evolution of outstanding achievements, there are equally few in which the authors of these advances have not owed a large measure of their success to the happy inspiration of their imaginations, all of which is discussed in an article entitled "Scientific Guesswork." Although the port of Swansea is placed on the banks of the River Tawe, it may for all practical purposes be regarded entirely as an artificial port, the discharge of the river being trifling as compared with the volume of tidal water ebbing and flowing between the pierheads. The peculiar conditions of that port have necessitated the construction of a most wonderful dock, possessing a water area of 5 acres in addition to the area of the deep-water extension which, when it is completed, will add 40 acres to the total. This remarkable scheme is described by C Van Langendonck. C L de Muralt writes on modern development in heavy electric locomotives. Among the very subtle notions which often embarrass the teacher of mechanics, none more frequently leads to erroneous interpretations than the two aspects in which acceleration may be considered, but there is also none which when once mastered is more fertile of results in thorough instruction. For that reason teachers will no doubt read with interest Mr C E Guillaume's excellent article entitled "Paradoxes of Acceleration." One reason why the turbine has not completely supplanted the reciprocating engine in ship propulsion is to be found in the fact that it is not reversible, and in the second fact that screw propellers are most efficient at a rate of speed considerably lower than the rate of speed which is best for efficiency and economy of turbine operation. To overcome these drawbacks Dr H. Foettinger has invented a system for which he claims not only a high degree of efficiency, but reversible action without mechanical complications. The feature of this invention which is most thoroughly described in the current SUPPLEMENT is a relatively light and simple hydraulic transmission device, the so-called turbo-transformer G H Bryan contributes some new ideas on the subject of aeroplane stability

NEW AUTOMOBILE RECORDS AT ORMOND BEACH.

Once again the famous sands of Ormond Beach have been used for making new records with automobiles. During the three days' meet held last week Barney Oldfield once more beat the world's record for speed with his new 200-horse-power Benz racer, a picture of which is reproduced herewith. This machine broke four world's records last fall upon the Brooklands track in England, and so it is not to be wondered at that upon the smooth sands of Ormond it traveled two miles in the fastest time ever made by an automobile The distance was covered in 55 87/100 seconds, which is nearly three seconds better than the record of 58 4/5 made by Demogeot in 1906 with a Darracq car The rate of speed traveled by Oldfield is 128 89 miles an hour Oldfield also made new records for the kilometer and the mile; he covered the 3,280 feet of the first-mentioned distance in 17 4/100 seconds. The previous record was 17 76/100 His record for the mile, which was made a week previously, was 27 33/100 seconds, a speed of 131 72 miles an hour Walter Christie's front-drive racer covered this distance in 30 29/100 seconds, or at the rate of 118 46 miles an hour



THE 200-HORSE-POWER BENZ RACER IN WHICH OLDFIELD MADE 128 89 MILES AN HOUR. A NEW WORLD'S RECORD

In the stock car races, Oldfield made a new record of 40 35/100 seconds for one mile in a Knox machine. This make of car also won the 10-mile free-for-all in 8 41/100 minutes, a Chalmers 40-horse-power car took second place, the 10-mile handicap was also won by a Chalmers car, which beat the Pope-Hartford, the time being 12 minutes and 12 seconds. On the last day of the meet, in the one-mile speed trials, Oldfield covered the distance in 27 33/100 seconds. The 10-mile stock chassis race for cars having a piston displacement of 161 to 230 inches was won by Hart in a Buick in 12 minutes and 58 seconds, or at the rate of 46 27 miles per hour A Hudson machine came in second In the 10-mile handicap a Darracq car driven by Kirscher won in 7 21, Oldfield on a Knox was second and Bond on a Stearns third A second 10-mile handicap race was won by Altman on a Hudson in 12 45, Oldfield with a Knox was again second, and Kirscher third.

In the one-mile speed trials the Darracq covered the distance in 37.24, and Walter Christie made it in 33.15.

While the races this year were not very numerous, Oldfield created a great deal of enthusiasm by his record-breaking driving, and it is probable that next year still other attempts will be made to reduce the time for short distances. The machine Oldfield used is in every way similar to a regular stock car except that it has a much larger engine of 185 x 200 millimeters (7.3 x 7.9 inches) bore and stroke, capable of developing considerably more than its rated horse-power.

A large portion of the old French plant at Panama was found to be serviceable, and is doing good work on the canal. Since 1906 the useless junk has been sold as scrap, and up to January, 1910, over ten thousand tons have been shipped and sold.

The Nature of the Interior of the Earth.

Especially during the past few years the structure and temperature of the interior of the earth have been an object of lively and insistent discussion, and not a lesser result of it is the plan to bore a hole to the kernel of the earth, by means of which may be investigated all the strata of the globe, which as they succeed one another toward its center indicate an increasing temperature in conformity to a law Flammarion particularly has quickened this question very recently, and with it has busied the fancy both of expert and of layman. As lending further vivid importance to the discussion, the gist of certain chapters of Dr W L Meyer's book, "Bewohnte Welten" (Inhabited Worlds), recently published, may be cited It affords a most interesting estimate of the temperature of the crust of the earth and of the interior volume of our native planet. This research discloses that the varying temperature of the atmosphere exercises an influence on the temperature of the crust of the earth only to quite inconsiderable depths. Already at a distance of fifteen to twenty meters below the surface a uniform temperature of 9 deg Celsius approximately has been ascertained, which prevails around the whole earth. With increasing depth the degree of heat is enhanced. This increase is called the geothermal degree of depth. In many holes that have been bored it varies with much frequency Generally 1 deg of increase of temperature of rock is indicated as often as 33.3 meters of greater depth are added. This result is due to the mode of observation that informs us of the characteristics of two kilometers, or the thirty-two-hundredth part, of the distance toward the center of the earth. Here at this depth a temperature of 50 deg was ascertained. If this manner of calculation be continued for greater degrees of depth the immediate result is that already at 60 kilometers, approximately, the constituents of the crust of the earth are in fiery solution, and at 300 kilometers must be in the form of gas. The latest investigations conducted by Meyer remind us of the research of Tamman and others and of the results of experiments made to measure the speed of the progress of waves of seismic disturbance. The collective result leads to the conclusion that the real firm crust of the earth cannot be specifically thicker than 100 kilometers. Among the phenomena sustaining this conclusion is the so-called magma which is occasionally expelled in a volcanic eruption, when nearer to the center of the earth it has the form of gas, but under such stupendous pressure that at the distance aforementioned the substance seems to have the appearance of wax. So it is assumed that the temperature of the center of the earth lies between 20,000 and 100,000 deg

At this juncture Dr. Meyer seeks to satisfy the curiosity of the inquirer with his statement of the equation of heat that occurs between the earth and the sun; the store of heat, great beyond human computation, that streams forth over the geothermal degrees of depth from the interior of the earth into endless space is so far counterbalanced by the heat imparted to the earth by the rays of the sun that no decrease of the mean temperature of the surface of the earth can be ascertained It must be noted therefore, that as on the temperature of the earth depend the most important processes of life, these are assured for an indefinite time at least.

An Eruption of Etna.

On March 24th the Sicilian volcano Etna began to erupt. The lava united in a vast stream 24 feet high and 1,200 feet wide, and at the time of going to press was threatening the destruction of Belpasso and Borello.

The lava devastated large tracts of cultivated lands, such as vineyards and orchards, and has wrought havoc in the woods. The village of Nidolo, near Nicolosi, has been covered completely, and many huts and farmhouses have been destroyed.

BUILDING THE HUGE CONCRETE LOCKS AT GATUN, PANAMA.

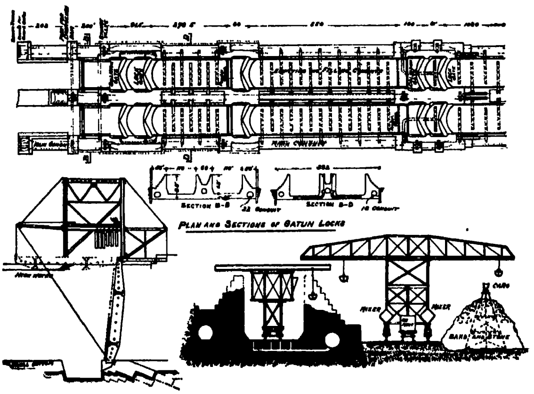
SPECIAL APPLIANCES BY WHICH THIS HUGE ARTIFICIAL MONOLITH, 400 FEET WIDE, 4,000 FEET LONG, AND 90 TO 100 FEET DEEP, IS CONSTRUCTED

The work at Panama, and particularly at the great flight of double locks at Gatun, has now reached a stage at which the camera is able to catch some adequate impression of the titanic proportions of the work and record it for the interest of the outside world We have all understood that the scale upon which work was being done at Panama was impressive, but it remains for the accompanying pictures to teach us just how stupendous is the mass of masonry which is slowly taking shape near the Atlantic end of the canal.

The locks at Gatun will pass vessels up or down between sea level and the level of the lake which will be formed by the great Gatun dam immediately adjoining the locks. The total height of 85 feet will be covered in three flights of approximately 28 feet each. In order to provide ample accommodation for future increase in traffic, and also as a contingency against total disablement of one of the locks, they are being built in duplicate, as shown in the plans herewith presented Each lock will be 110 feet wide, and will have a usable length of 1,000 feet To provide against the carrying away of gates and the consequent rush of water out of the lake the former will be built in duplicate, with a considerable space of water between them, so that if a ship, overrunning, should strike the first gate, the second will remain intact Also, at the entrance to the upper lock, there will be a huge swing bridge which, in the event of the gates being carried away, can be swung across the lock entrance, and a series of horizontal, vertically sliding steel gates lowered down from the bridge, thus effectually shutting off the flow of water Heavy fender chains will also protect the gates by receiving the first shock of a collision and thus, partially if not altogether, absorbing the momentum.

But the present story is concerned with the methods which have been adopted for building this huge monolithic, or unjointed, mass of artificial masonry, into the construction of which will enter about four million cubic yards of concrete In general, the locks may be described as consisting of a floor, 400 feet by 3,900 feet in area, and of 20 feet maximum thickness, of two side walls, 50 feet in thickness at their lowest part, and of a central dividing wall, 60 feet thick (See diagrams.) The clear height of these walls from the floor of the dock to the coping is 68 to 96 feet. The inner faces forming the sides of the lock are vertical. The outer faces are built on an incline and are stepped, the horizontal thickness increasing with the depth of water in order to resist the lateral pressures For emptying and filling the locks a series of transverse culverts, formed in the floor, lead to large longitudinal culverts in the base of the walls (Figs. 1 and 6), the latter ranging in diameter from a minimum of 18 to a maximum of 22 feet, the size varying according to the number of side culverts that are served. Now it can readily be understood that the cost of a work of this kind, involving the handling of 4,000,000 cubic yards of material, depends very largely upon the amount of labor involved For in works of this character the cost of labor is the principal item, and hence much thought has been given to the design of the appliances for handling the concrete and the huge "forms" (temporary inclosing walls) within which the concrete is deposited At the Gatun locks the sand and stone are deposited from cars in a stock pile running parallel with the lock site On either bank above the huge excavation in which the locks are being built are a series of lofty steel towers (see front page and Figs. 3 and 7), between which are strung heavy, steel cables, by which the buckets containing the materials are transported The concrete is picked up by these cables run over the excavation and lowered at the desired point

The first part of the concrete work consisted in the laying of the huge slab of concrete, 392 feet wide and nearly 4,000 feet long, with a maximum thickness of 20 feet, which forms the floor of the locks. During the construction of this floor, care was taken to provide circular transverse conduits with vertical openings through the floor which led alternately to opposite side walls, there to connect with the main longitudinal, emptying and filling conduits. The next task was to erect the side walls, and it is this interesting work which is shown so clearly in the accompanying illustration



Cross-section of emergency dam in the closed position, with wicket girders down and sliding gates partly in the lowered position

Diagram showing method of building the locks Sand and stone are lifted from the stock pile to the mixers, and from the mixers the concrete is carried to the lock site by the two cantilever cranes

How the 4,000,000 cubic yards of concrete are being mixed and built into place at the Canal locks.

BUILDING THE HUGE CONCRETE LOCKS AT GATUN, PANAMA

The walls are built in sections, each of which is about 40 feet wide, with a space of about 30 feet between them The wall is then completed by filling in the intervening vertical gaps

It is well understood that one of the most expensive elements in concrete construction is the building and manipulation of the forms in which the concrete sets In smaller structures these are composed of timber, but because of the huge amount that would be required and the big depreciation in the value of the timber after use this material was altogether out of the question The plan adopted is shown very clearly in our illustrations The forms are built entirely of steel (Figs 2, 4 and 5) Those for the inner vertical face of the walls consist of a series of massive steel towers of a triangular cross-section, to the vertical face of which is riveted a wall of steel plating, stiffened by horizontal channel irons. The towers are carried upon four 4-wheel trucks, two under the front and two under the rear face, which run upon two pairs of rails laid on the floor of the lock and parallel with its longitudinal axis The rear face of the walls, which is stepped, closed by a series of separate rectangular forms measuring about 6 feet on the vertical and 4 feet on the horizontal face The ends of each wall section are closed by means of steel plates supported against vertical movable framework Into the pocket as thus formed the concrete is dumped from the skips of the overhead cable, and tamped into place by the laborers, until the full 6 feet of height corresponding to the height of the rear stepping is completed The walls are thus carried up three at a time until they have reached their full height This work is very clearly shown in the front page engraving, where a skip is shown as having just delivered its load and the laborers are spreading and tamping the concrete

To assist in making a firm joint between the monolithic sections, vertical and horizontal key ways or pockets (Fig. 5) are formed in the abutting faces, which pockets are, of course, filled in with concrete as the intervening gaps between the walls are built up This system of keying, coupled with the natural adhesion of the concrete, will prevent any tendency to cracking or separation of the walls at these points under hydraulic or earth pressure or under the racking strains of an earthquake shock

A most interesting piece of steel form work is that

for forming the 18 to 22-foot conduits in the side walls. It consists of a flexible steel pipe (Fig. 1) heavily braced to resist deformation, which has a longitudinal hinge at the top and at the bottom is provided with heavy left and right screws by which the form is kept to its full dimension during the laying and setting of the concrete. To remove the forms, the screws are turned and the bottom edges of the form are drawn together, thus reducing the diameter and allowing the form to be drawn clear of the conduit.

A most interesting picture is Fig. 3, showing the work at the entrance to the locks from Gatun dam. To the right is seen the rear stepping of the easterly wall of the easterly lock. The circular timber work shows the position of the upper end of the first lock. Just beyond this are two sections of the steel forms for the main central conduit by which water will be led from the lake to the upper lock. Just beyond the wall which extends across the picture to the right-hand bank will be located the emergency dam above referred to, and beyond that will extend the three piers which will form the lock entrance from the lake. The embankment which will be seen running out as an extension of the natural bank to the right of the picture is the rock fill forming the southerly toe of the great Gatun dam, which extends to the right across the valley to a junction with the distant hills. The lake of water seen to the right of the rock embankment is formed by the hydraulic dredges which are being used in making the Gatun dam. Half a mile to the north, also extending across the valley from the northerly end of the locks, is a similar rock fill, and huge dredges are now engaged in pumping silt and water from the Chagres, and from the various contiguous channels, into the big basin half a mile wide and over a mile long thus formed. The water drains off through the rock fill, leaving the fine silt in a firmly compacted, impermeable mass, which is so dense that it will be impossible for the waters of the lake ever to seep through.

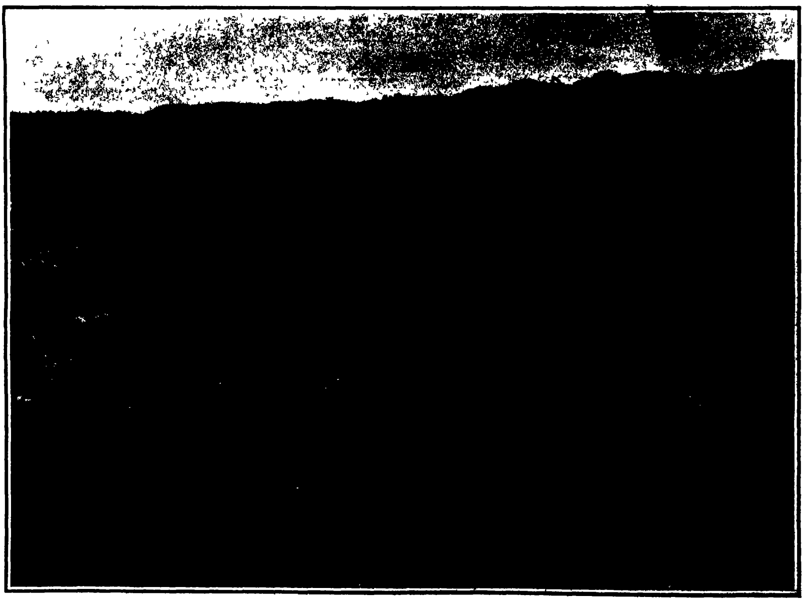
If the reader have sufficient imagination he can, by

The conduits are formed in the body of the side and center walls. The forms consist of collapsible steel cylinders, hinged at the top, split at the bottom and kept in place by big right and left screws. The latter are loosened when the concrete has set, allowing the two halves of the cylinder to swing inwardly and be withdrawn.

Fig. 1.—An 18-foot conduit for emptying and filling the locks.

Looking into the middle lock excavation from the east bank. To the left, section of side wall with forms yet in place. In center of excavation, the middle wall is being built in sections. To the right is a side wall section showing the movable form in place and a portion of the track upon which it is transported.

Fig. 2.—General view of middle lock.



In foreground is the timber form for upper end of upper lock. In center of stepped wall are the steel forms for conduit for filling the locks. Beyond the wall will be the emergency dam and the entrance piers, which will extend several feet into Lake Gatun. To the right is the rock fill which forms the southern toe of the Gatun dam. Back of it are the water and silt, which have been pumped up from the Chagres to form the main body of the dam.

Fig. 3.—General view of south end of Gatun locks.

BUILDING THE HUGE CONCRETE LOCKS AT GATUN, PANAMA.

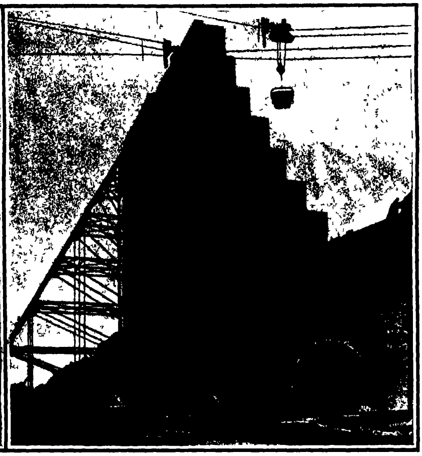
looking at this picture, fairly depict the scene as it will appear when the canal is completed, supposing, of course, the side wall were broken away to give him an unobstructed view. To the right the bank will be shut off by the walls of the lock structure, and to the left he will see the three concrete piers extending far out into a vast lake of water which will cover all the space now occupied by tracks, telegraph lines and embankments, and will extend in an unbroken surface until it reaches the hills in the far distance.

Efficiency of Steam Turbine Nozzles.

Some experiments upon steam turbine nozzles, expanding steam from ordinary boiler pressures to condenser pressures, are described in a paper presented to the American Society of Mechanical Engineers by Prof. Sibley and T. R. Kemble. The main results are worth noting, and confirm the claims made for the efficiency of nozzles by turbine makers. Efficiences of from 90 to 95 per cent were regularly obtained. The actual discharge from the nozzles, stated as a percentage of the theoretical discharge, was of the same order as the efficiencies. Most interesting however, was the apparent lack of influence exerted by the form of the nozzle even when this might have been expected to be considerable, as, for instance, when the section changed from circular at the neck to square at the discharge or when a conical needle protruded into the nozzle from the inlet end. Smoothness of surface was, however, an important factor.

These movable forms, consisting of vertical plate steel walls carried on trussed steel towers, are each mounted upon four four wheel trucks, and run upon two lines of double track, extending the full length of locks.

Fig. 4.—Steel forms in place for building center wall.



This is a completed section of the middle lock side wall. It is 50 feet wide by [illegible] feet high. In the base is one of the main filling and emptying conduits. The vertical recesses are to assist in keying the section together.

Fig. 5.—A completed section of side wall.

This wall, carried down everywhere to solid rock, will serve to prevent seepage of water through the earthen dam.

Fig. 6.—Portion of concrete core wall, Miraflores dam.

The gaps will be filled with concrete, keyed and cemented firmly in place, thus providing a continuous monolithic wall. The steel angle plate forms are already set up across the further gap.

Fig. 7.—Sections of easterly side wall, upper lock.

BUILDING THE HUGE CONCRETE LOCKS AT GATUN, PANAMA.

THE HEAVENS IN APR[illegible]

BY HENRY NORRIS RUSSELL, PH.D.

THE great comet which was so conspicuous in January is again observable in the morning sky, just before daylight but only with telescopic aid. Its orbit is now well determined and it appears that it was nearest the sun, at a distance of 10,000,000 miles, about the time of its greatest brightness, and that its rapid fading was due to its steady recession from both earth and sun. Its orbit is probably very nearly parabolic. That it could not be of short period was clear at the time of discovery for so bright an object could not have escaped being seen often before, if it had come around at moderate intervals like Halley's comet.

The latter is invisible behind the sun during the early part of April, but is well placed for morning observation toward the end of the month. At this time it appears almost stationary in the heavens south of the eastern edge of the great square of Pegasus and is high enough to be observed before 4 A. M. Its distance from the earth decreases from 158,000,000 miles on the 1st to 77,000,000 on the 30th, and its apparent size and brightness will steadily increase. By the end of the month it will doubtless be conspicuous to the naked eye.

While waiting for this, we will find abundant occupation among the stars. Before we trace out the constellations into which the imagination has grouped them, let us study a *real* family of stars, whose relationship has but recently been discovered.

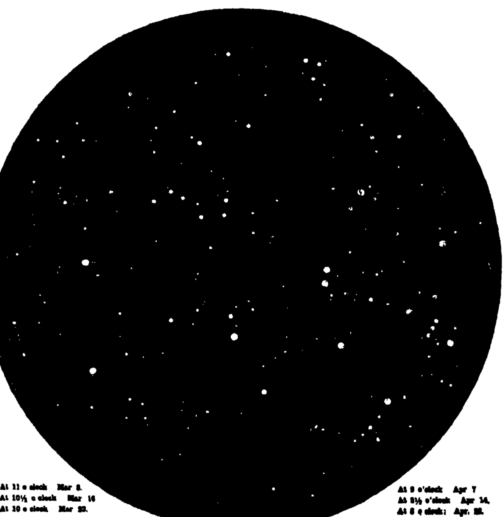
It has already been told in these columns how Prof. Boss has identified about forty members of a group of stars in Taurus which are keeping together in their movement through space like a flock of wild geese in the air.

It has also been known for some time that five of the bright stars of the Great Bear form a similar group, and recently, through the studies of two German astronomers, Ludendorff of Potsdam and Hertzsprung of Göttingen, it has been found that several other conspicuous stars, in different parts of the sky, also belong to it. All these stars are really moving in the same direction, and at the same rate, and hence they all appear to be moving away from the same point in the heavens, though in quite different directions, for some pass our system on one side and some on another. They ought on this hypothesis still to be approaching us, and the spectroscope shows that this is actually the case, the observed velocities of approach agreeing closely with those predicted by theory.

The stars of this system are shown on our map. First comes the group in Ursa Major—the stars β, γ, δ, ϵ, and ζ, all in the Great Dipper—with Alcor the small companion of Mizar (ζ), and also two other stars not shown on the map, one of them about a degree from ϵ, a little above the line joining it to ζ and the other the northernmost of two fifth-magnitude stars not quite half way from β toward ν, which latter star is shown on the map north of θ.

All these eight stars are relatively about as close together as they look to us, and are at about the same distance from our solar system—65 to 75 light-years. This can be calculated with accuracy when once we know how fast they are really moving and how fast they seem to move. The point from which, owing to perspective, the motions of all these stars appear to be directed is on the borders of Ursa Major, and is pointed out by a line from θ through κ Ursae Majoris, carried as far again. The other stars of the group are identified by the fact that their apparent motions are also directed away from this point, though they are widely scattered over the sky. Two of them are nearly in line with the stars of the Dipper, though far removed on each side—β Aurigae and α Coronae. The former is the remotest of the group, about 150 light years away, while the latter is about as far off as those previously described.

Farther southward, in quite a different direction, is the star δ Leonis, whose calculated distance of 39 light-years puts it much nearer than these others, and suggests that direct observations of its parallax would be desirable. Finally, and most remarkable of all the splendid Sirius is undoubtedly a member of the same group. It owes its brightness to its relative nearness to us—only 8½ light-years according to the demands of theory which in this case is confirmed in a most satisfactory way by direct observation.



At 11 o'clock Mar. 8.
At 10½ o'clock Mar. 16.
At 10 o'clock Mar. 23.

At 9 o'clock Apr. 7.
At 8½ o'clock Apr. 14.
At 8 o'clock Apr. 22.

At 9½ o'clock March 30.

NIGHT SKY: MARCH AND APRIL

When the actual brightness of the other stars of the system is computed it is seen that Sirius is actually one of the fainter members of the system. Its total light is about thirty times that of the sun while that of the principal stars of the Dipper and of α Coronae averages fully twice as much, and that of β Aurigae is about ten times as great. Delta Leonis, on the other hand, is only about ten times as bright as the sun, and the fainter stars near the Dipper, belonging to the system, while still exceeding the sun in luminosity, are only two or three times as bright.

This system therefore consists of unusually bright stars. It is remarkable also for the great extent in space. Between the outer stars of the group there must be hundreds of stars, of which our sun is one, which have no connection with it. It is as if a dozen men were all walking through a confused crowd, all in the same direction and at the same speed. Though many of the crowd intervene, the mere fact of their progress toward the same point serves to distinguish them, and is a mark of their common origin.

It may be added in conclusion that a very large proportion of these stars, at least six out of the ten shown on the map, are either visually or spectroscopically double. Turning now to the constellations, we may fix our eyes first on the N[illegible] Little Bear, to which this belongs, w[illegible] most conspicuous groups, is easily [illegible] a tolerably good "Dipper," though less [illegible] phrase may be pardoned) than its larger [illegible]. The figure of the Bear, as shown in our [illegible], can hardly be made out except that the line [illegible] ing in Polaris makes quite an unnat[illegible]. Polaris itself, apart from its position [illegible] as a double star, observable with [illegible], while the spectroscope shows that [illegible] of the two is attended by two invisib[illegible] with a period of less than three da[illegible] more remote, with one of several [illegible].

Around the Bear coils the Dra[illegible], almost overhead, the Great Bear [illegible]. South of this we find the Lion, [illegible] the southern sky, the ungainly leng[illegible] pent, Hydra. Above this come the [illegible] of the Crow and the Cup, and [illegible], all whose [illegible] surpassed [illegible] their companion. In the east we see the [illegible] Arcturus, and lower down the semicircle of the Crown, and Hercules [illegible] rising. [illegible] around to the north, we find Cepheus and Cassiopeia, below the Pole, and then [illegible] and Auriga in the north-west. Taurus is [illegible] in the west, and Gemini above him, with the [illegible] Mars between the two. Orion and Canis Major are the southwestern sky, with Canis [illegible].

THE [illegible]

Mercury is [illegible]ly a morning [illegible] the 5th, and [illegible] star after that [illegible] he will not be observable until the latter part of the month, when he sets an hour and a half after the sun and should be [illegible] seen shortly after [illegible]. At this time he is in Taurus, and on the [illegible] he passes close [illegible] Pleiades, which he [illegible] surpasses in brightness.

Venus is a morning star, rising about 4 A. M. on the 1st and 3.15 A. M. on the 30th. She is extremely brilliant, and cannot possibly be mistaken.

Mars is evening star in Gemini, slowly moving eastward among the stars and still losing in brightness as he recedes from us. He is very far north all through the month, and consequently [illegible] in sight until after [illegible] P. M.

Jupiter is just past opposition, and dominates the evening sky. Telescopically, the transits and eclipses of his satellites are among the most fascinating spectacles in the heavens, especially when the round black shadows of the satellites can be seen on the planet's disk, as happens on the 3d, 9th, 10th, 18th, and 25th during the evening hours in our part of the world.

Saturn is in conjunction with the sun on the 16th, and is unobservable throughout the month.

Uranus is in quadrature west of the sun on the 15th, and is observable in the morning. Neptune, which is in a similar position on the opposite side of the sun on the 7th, can be seen, with a suitable telescope, in the evening.

The moon is in her last quarter at 8 P. M. on the 2d, new at 4 P. M. on the 9th, in her first quarter at 9 A. M. on the 16th, and full at 8 A. M. on the 24th. She is nearest us on the 10th, and farthest away on the 24th. She is in conjunction with Uranus on the 2d, Venus on the 6th, Mercury and Saturn on the 9th—the three bodies being apparently close together, but also so near the sun that they cannot be seen—with Mars on the 12th, Neptune on the 13th, and Jupiter pretty closely on the night of the 21st.

Princeton University Observatory.

NOVEL CHANGEABLE PHOTOGRAPHS

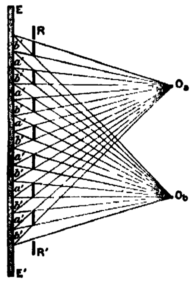
BY F. HONORE

Prof. Lippmann recently described before the Academy of Sciences at Paris some novel changeable photographs made according to a method devised by M. Estanave, secretary of the Faculty of Sciences of Marseilles.

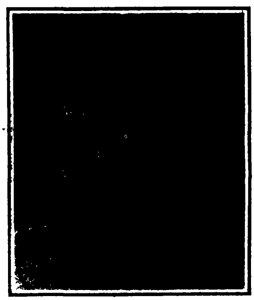
M. Estanave produced a dia-positive on glass of a sleeping woman. By inclining the picture a few milli meters and rocking it slightly, the eyes apparently open like the eyes of a porcelain doll, with the exception, however, that the entire face livens up in a most extraordinary manner Incline the picture again and the eyes slowly close again The photographs when reproduced for publication in a paper such as the SCIENTIFIC AMERICAN unfortunately cannot be used to obtain the effect because of the necessity of employing a special half tone screen

In order to explain how M Estanave obtains his picture, let us consider two different photographs—the one D representing a sleeping woman, the other E the same woman awake Each photographic positive is ruled horizontally from top to bottom, so that both photographs appear finely banded If we remove from the positive D even alternate pairs of bands, and from the positive E odd alternate pairs of bands, and if we place upon the positive D the bands taken from E and upon E the bands taken from D, we will obtain two new pictures which we may designate D^1 and E^1 These new pictures D^1 and E^1 are composites of D and E If the bands are narrow enough, 30 per centimeter for example, their discontinuity will not be noticed The composite pictures will apparently be complete and comparable with the half-tone pictures to be found in the SCIENTIFIC AMERICAN or in any other modern illustrated periodical

Let us now combine the two composites D^1 and E^1 In other words, let us transpose strips of D^1 and strips of E^1 without disturbing their order We obtain still another positive D^2, formed by the combination of the two preceding positives. When looked at directly this new positive D^2 is rather confusing, but when looked at through a glass plate ruled alternately with horizontal opaque and transparent bands of a width equal to those constituting the positive itself quite a different effect is obtained If we hold this glass screen in such a manner that the opaque bands cover the bands of the positive E^1 we will see only the bands of the positive D, and we will obtain the portrait of a sleeping woman On the other hand, if the screen be slightly shifted so that the bands of the positive E^1 are covered we will have a portrait of a woman wide awake Since the different effects are obtained simply by shifting the screen, the single photographic view seen through it can be caused to change its appearance very rapidly simply by changing the speed of the screen movements



MODIFIED FORM OF THE DISCOVERY.


THE SLEEPING WOMAN

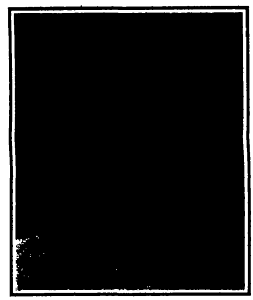
In actual practice the ruling of the positives and the transposition of the bands, as well as the use of a suitable screen, is attended with considerable difficulty For that reason, M Estanave has devised a simpler method which is illustrated in the accompanying diagram

Let a and b be two different objects the luminous rays from which fall upon a sensitive plate or a ground glass EE' In the path of these rays at a suitable distance, the horizontal ruled screen RR' is placed In the diagram the spaces separating the lines of the screen are considerably exaggerated and the screen itself is shown in vertical section Such is the position of the screen that the sensitive plate will receive a series of images of a' alternating with images of b'

In making the positive photograph according to this method, the subject is first placed at Oa and then at Ob At Oa the subject must appear asleep, and at Ob wide awake A composite picture will be obtained on the sensitive plate If this picture be examined through a screen similar to that by means of which the picture was made, and the visual angle be varied either by shifting the eye or shifting the screen the portrait will apparently open and close its eyes

Theoretically several different pictures can thus be superimposed In actual practice M Estanave has combined three which are clearly visible However there is a limit to the number of pictures that can thus be combined for the positives become more and more incomplete as the filiform bands composing them are more and more elongated In the case of two aspects, the elements of an image are adjacent, the one to the other with three aspects, the consecutive elements of an image are separated by two elements belonging respectively to each of the two other images, and so on

In order to simplify the adjustment of the screen relatively to the composite image, and in fact to avoid adjustment entirely M Estanave employs an improved auto-stereoscopic plate which he has invented This plate is ruled with a screen on the side which is not emulsified, the rulings being such that alternate opaque and transparent bands are produced The new invention of M Estanave's is so conceived that the plate serves a double purpose The plate is mounted with the ruled surface in front, or it can be so placed that the ruled surface is either horizontal or vertical When the ruled surface is placed horizontally changeable photographs are obtained With the ruling vertically placed images can be obtained directly visible to the eye with a stereoscopic effect With two stereoscopic lenses mounted so as to obtain filiform images formed by the superposition of the two images of the object taken under the same aspect, the vertical lines of the screen select for each eye the particular image of the stereoscopic couple which are intended for it


THE WAKING WOMAN

Mother-of-Pearl Imitations.

At a very early period repeated efforts were made to replace mother-of-pearl, so expensive at times, by some substance possessing the same valuable properties, but the results arrived at always fell far short of the expectations which were entertained, and these attempts were, therefore, gradually entirely abandoned Recently attention has again been directed to the same problem, it being believed that the progress made in chemistry and applied science afforded grounds for hoping for more favorable results And, in fact, some of the imitations of mother-of-pearl now made seem to show that these expectations will not be disappointed. It is true that hitherto but few detailed directions for making artificial mother-of-pearl have appeared in technical literature, for the simple reason that the methods which have led to successful results have for the most part been kept carefully secret, but a careful study of international patent literature shows that there are now various processes for making these imitations, some of them resting on a solid scientific basis. It is at once evident that imitations such as sheet gelatine steeped in fish-scale essence, or Cologne glue saturated with aluminium silver will never gain a footing as genuine substitutes when, for instance, not even the well-known celluloid mother-of-pearl can gain recognition as an equivalent. The purpose to which artificial mother-of-pearl is applied determines the degree of its efficiency as a substitute, and this degree of efficiency in its turn depends mainly on its external resemblance to the natural product For combs, hat pin heads, etc. celluloid mother-of pearl may be used without hesitation as an imitation, for ornaments, on the other hand, such as fastening pins, buckles, etc, the preference will naturally be given to substances whose external resemblance to the genuine material is complete or nearly so Special interest, therefore, attaches to a new method of preparing artificial mother-of-pearl, which we proceed to describe in detail

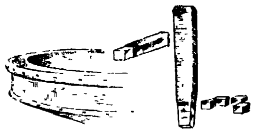
The ascertained fact that collodion, mixed with carbon bisulphide and a few parts of pearl-silver fluid, yielded a substance more or less resembling mother-of-pearl, led to a method of working directly with cellulose solutions, and in this way the celluloid mother-of pearl already mentioned was obtained a material which has been used for a variety of purposes in the industrial arts. As, however, the inflammability of celluloid considerably restricted the employment of this new material, efforts were made to replace celluloid by another substance This substance was cellite The process of preparing artificial mother-of-pearl from this base is as follows 100 parts of cellite dissolved in 80 to 90 parts of glacial acetic acid or chloroform are mixed with 20 parts of calcined magnesia and 4 to 8 parts of pearl essence, with continual stirring In this way a more or less viscid mass is obtained which is allowed to dry in the air If a few drops of carbon bisulphide are added to the liquid solution a beautiful iridescent luster is imparted As cellite dissolves comparatively slowly, it is advisable to prepare the solution a day or two beforehand In case of need, the process of dissolving may be somewhat accelerated by slow heating in a water-bath When dry the artificial mother-of pearl presents the appearance of polished mother-of pearl plates but in addition it is distinguished by great ductility and elasticity The treatment of this artificial product is, therefore much easier than that of genuine mother-of-pearl It has also been attempted to substitute mother-of pearl dust for magnesia and very satisfactory results have been obtained in this way It is also possible by means of this process to produce artificial pearls exactly like real ones For this purpose the artificial product is prepared in rather thick plates from which sticks are cut and pearls of any desired size and form turned on the lathe Those pearls are superior in point of resemblance to the natural product to the fish or wax pearls hitherto made from glass and are not so brittle as the latter —Deutsche Goldschmiede Zeitung

NOTES ON OVERHAULING A BOAT

BY ALBERT F. BISHOP

Square Bunging for Boats.—I think square bungs are a big improvement over round bungs. They do not weaken the planking or chafing streaks and may more quickly be inserted.

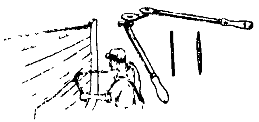
The chafing streak on a round stern that has been bunged with round bunging invariably breaks sooner or later where the round bungs have been inserted. Where the square bung is used the nail is driven and



SQUARE BUNGING

set. The square punch which is a trifle larger than the nail head, is then driven in making the aperture for the square bung. This punch should be hardened and ground on an emery wheel making the corner just as keen and sharp as possible. Oblong rectangular bungs are preferable where the boat nail is used in planking etc. The bungs are quite easily made 5/16 of an inch square with a small buzz saw, tilting the saw table slightly to produce the taper on two sides of the bung.

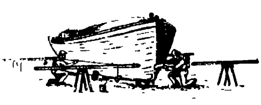
Wheel Calker.—The wheel calker illustrated herewith will easily force cotton into solid wood where there is no seam or joint. The shape gives one considerable leverage. The cotton is first placed along the seam by attaching it with the point of a knife at short distances, just enough to keep it in line with



WHEEL CALKER.

the joint. It is now ready for the knife shaped wheel, which calks it very rapidly. Take a strip of iron ⅜ by ⅜ inch thick, 2½ feet long and bend it to a flaring U shape. The bottom of the U should be 4 inches across and to it the wheels are riveted. The iron strip should be drawn down a little on the ends to receive the handles. The wheels are 1¾ inches in diameter. One of the wheels has a square edge 1/16 of an inch thick. The other wheel is 3/16 of an inch thick with the edge sharpened like a knife. There is a simple gauge placed on the framework near the square edged wheel which allows one to force the cotton to the desired depth to receive the putty.

Marking the Water Line on a Boat.—Level the boat athwartships and decide where you would like your water line, which in the case of a launch or small motor boat should be from two to three inches out of water when the boat is afloat. Take two straight edges 12 or 14 feet long placed level athwartships to the boat one at the bow and one at the stern at the height of the water line decided upon. Stretch a



MARKING THE WATER LINE ON A BOAT.

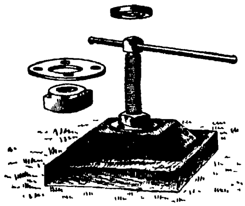
cord across the straight edges with the weight at each end to keep it taut and let it just touch the bilge of the boat so that you may dot your water line along the hull. The proper way to make a true line is with a thin batting 3 or four inches wide and 10 or 12 feet long with the upper edge pressed against the boat to correspond with the dots. Be particular to keep the batting exactly plumb edgeways and you can correctly scratch in your water line.

Simple Method of Weighing a Boat.—Take a lever six or eight feet long, place a fulcrum on the ground near the bow. Let the fulcrum (at 2 in the drawing) be just six inches from the end (1) of the lever that is under the bow of boat. A person that would weigh, say a hundred and fifty pounds, should work along on the lever, say to 3 or until the weight of his body would just lift the bow of the boat clear of the block ing. With a piece of chalk make a mark on the lever at this point. Divide the distance from the fulcrum to the chalk mark into 6-inch spaces and add 150 pounds for each space. For instance, eight space

WEIGHING A BOAT WITH A LEVER.

would mean 1,200 pounds, which would be a little less than half the weight of the boat, as the bow end is generally the lighter. Now raise the stern with the lever in the same manner. The boat being heavier at this end will call for more spaces. When this weight has been determined add the two weights and the result will not be far out for the entire boat. The blockings the boat rests on while the boat is lifted should be at the extreme end.

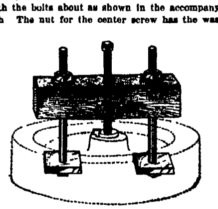
A Home-made Lifting Jack.—The jack here illustrated is made with a screw an inch in diameter and eight or more in length and a good heavy nut, the corners of which have been notched down with a file to receive a heavy washer. The part of the nut which comes through the washer should come through far



A HOME-MADE LIFTING JACK.

enough to allow for good heavy riveting on the washer. This makes the base for the nut to rest on and it is then placed on a wooden block, which is well secured with four wood screws. The base of the jack is a heavy block placed with the grain running at right angles to the upper block which holds the nut. The cap and lever require no description. The broad base prevents the jack from settling in the earth and from capsizing as well, which is a good feature around boat work.

A Home-made Wheel Puller.—A simple wheel puller can be made by taking a piece of maple about 3½ inches square and about sixteen in length and fitting it with the bolts about as shown in the accompanying sketch. The nut for the center screw has the washer

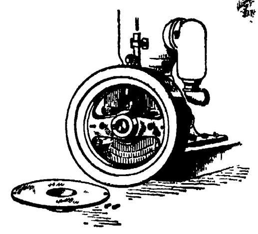


HOME-MADE WHEEL PULLER.

attached to it in the same way as in the lifting jack and it is similarly attached to the maple. The wheel bolts carry two broad nuts to catch on the rear face of the web or spokes of the wheel. The wheel is shown in dotted lines. This device is often resorted to in removing wheels from gasoline engines. This implement and the lifting jack have been in use four or five years. They have stood lots of wear and apparently are as strong as ever. A greater leverage on the wheel puller is obtained on the outside by a with any suitable wrench.

Convenient Flywheel for Gasolene Engines.—Most all the flywheels for small marine gasolene engines are filled up with spokes or webs with few holes in them, which makes it very awkward to get at the eccentric strap and pump to tighten the nuts and stuffing box. Nearly every time this is done the man in charge of the engine uses a cold chisel or screwdriver with a hammer. I have designed a wheel and used it on my engine for four years. It has only two spokes and a hand rim, doing away with the cranking handle, which is a dangerous feature. The plate tying the floor covers the key as well as the spokes, and is attached with two machine screws.

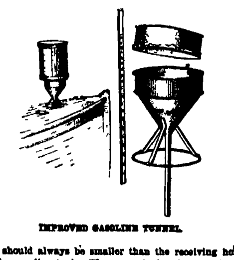
This makes a very tidy looking wheel and absolutely safe because there is no danger of being



A CONVENIENT FLYWHEEL.

caught in the spokes. It is a great convenience in cleaning behind the wheel or repainting, as it does not take a minute to remove the cover plate if desired. A wrench is the proper thing to use on the nut instead of a cold chisel. It can be done with this style of wheel is used.

Tunnel for Gasoline.—The tunnel here shown is a practical one. You can capsize a five gallon can of gasoline and allow it to rest in the tunnel until it is empty, as illustrated in Fig 1. A breeze of wind will not blow it one side slopping it over, which always happens when trying to pour out of the can into the ordinary tunnel. The practical tunnel has a long piece of ⅝ inch tubing which goes well down into the tank



IMPROVED GASOLINE TUNNEL.

and should always be smaller than the receiving hole in the gasoline tank. The supports for the tunnel are made out of galvanized iron 1 inch wide and 1/16 thick, bending the upper end to conform to the angle of the cone while the lower end is bent around a 3/16-inch galvanized wire hoop about ten inches in diameter. A trifle larger than the upper part of the tunnel is good proportion.

This part of the tunnel is a standard article which can readily be procured. The parts that are attached are well soldered. It is not necessary to rivet them. Place a wire gauge about fifty or sixty mesh to the inch inside of the tunnel. If a chamois filter is desired make a band of metal that will easily slip inside of upper part of the tunnel. The lower end of this is covered with chamois, which is held in place with small twine. Tack a strip of vulcanized fiber to the measuring stick.

The graduations of gallons should be marked with lamp black mixed with shellac. The vulcanized fiber turns a sharp and pronounced shade when dipped in gasoline, which is readily seen.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

ATTACHMENT FOR GARMENT-SUPPORTERS.—J. S. MARTIN, New Holland, Pa. The purpose of this invention is to provide an attachment which can be used in place of buttons, and which will cause the supporters to have a central draft on the garment instead of holding the garment up from one of its sides, whereby the garment will be so supported that it will be more comfortable to the wearer and will hang in better shape.

Electrical Devices.

TELEPHONE-TRANSMITTER.—W WHITTEN, Schenectady, N Y This invention is adapted for use in connection with heavy currents. It contemplates such a distribution of the carbon granules employed in the transmitter, that the current used may be employed as a slowly pulsating current, a rapidly pulsating or an alternating current, by merely changing the electric connections.

Of Interest to Farmers.

COTTON BALING PRESS.—E. A. WITHERS, Atlanta, Ga. An object here is to provide a cotton tamper driven by a slow acting power screw, in which the movement of the head is increased, thereby decreasing the time taken in pressing the successive changes, with means for changing the attachment of the head so that the movement of the power screw may be communicated directly to the latter, thereby increasing the power for baling purposes.

EGG CANDLING AND PACKING MACHINE.—H PIPPER, Vehling Neb The inventor provides a machine that holds for a short time the eggs being treated in position to be subjected to a light test for decomposition, and provides a machine which will automatically pack eggs in suitable receptacles. The machine is simple in construction and requires the attention of but one operator

Of General Interest.

CURRENT WATER WHEEL.—L. LAMBERT, Brownstown, Ill This wheel is of the kind adapted to be set in the side of a bank or at the end of a jetty so that the working half of the wheel may be exposed to the current. An object of the invention is to form a simple and efficient water wheel, which will utilize the energy in a flowing stream without the necessity of building a dam or the like.

MUSICAL GARDEN ORNAMENT.—A S. JAKOBSON, New York, N Y This ornament is for use in houses and gardens. It is beautiful and attractive to the eye, and produces by the action of gentle breezes thereon, a ringing sound of such ethereal sweetness and such delicacy and variety of tones which will appear to be at a great distance and yet indefinitely near, so that they will produce an almost magical soothing effect on the hearers.

PROPELLER-GUARD.—J L. HAWTHORNE, Paterson, N J To overcome the danger of submerged rocks, the inventor has designed a propeller guard which in general consists of a frame extending beneath the propeller shaft and propeller, both the shaft and guard being supported to swing upwardly when the guard strikes an obstruction, thus allowing the propeller to ride safely over

SCAFFOLD.—H O COFFIN, Terre Haute, Ind In the present patent the invention has reference to scaffolds, and it has for its object the provision of a scaffold which can be quickly erected or dismantled and one which when in position will afford a strong and ready support. All the parts are capable of being quickly packed for transportation.

COMBINED CANE AND CAMP-STOOL.—M KILJIAN, Elkton, Colo. This folding device can be easily carried about and will serve not only for a seat when unfolded, but may serve as a walking stick or cane when folded. The main folding parts are so arranged that when folded they will fit together so as to make a compact structure without sacrificing in any way the strength of the supporting members.

ANCHORING BASE FOR POSTS.—P T BAILEY, Newport, R. I. The object of this inventor is to provide a base in which there are two sets of anchoring spikes which may be driven into the ground after the base is set in position. The base has means for adjustably supporting a fence post, whereby the post may readily be alined.

FLASH-LIGHT.—H. A. WHITFIELD, New York, N Y In this case the object is to produce a flash-light having improved means for holding and exploding a cartridge or flash powder and further, to provide a construction which will enable the device to be used also for supporting and firing flash papers or flash sheets.

DERRICK DUMPING DEVICE.—C. H. PETERS, H. HARE, and S. C, STEINHOFFER, Brown Station, N. Y The device is arranged to permit of tilting the bucket at any time or in whatever position the boom may be in at the time For this, use is made of a dump drum and a dump line adapted to be wound up or unwound on the drum, the line passing from the drum through a sheave block, swiveled on the lower end of the mast, to then pass over hoisting means on the upper end of the mast and the outer end of the boom, to connect with the bucket to tilt the latter.

Hardware and Tools.

TOOL-HOLDER.—E. RAWSON, Lewiston, Idaho. Means are provided by which the tool may be quickly applied and detached from the holder, consisting of a locking member journaled in the spindle, a clutch, a wrench journaled in the clutch, movable into and out of engagement with the member, and means for moving the clutch to engage and lock the spindle against rotation during the operation of the wrench

SEAL-HOLDING MECHANISM FOR LOCKS.—C H JOHNSON, Petaluma, Cal. This hasp lock has novel details that enable the retention of a paper seal within the lock over the keyhole therein which, if perforated, or removed after the lid has been closed and secured by the lock, will expose the fraudulent opening of the lock, and receptacle upon which it is mounted

WRENCH.—H HAND and T HAND, Seattle Wash This improvement provides a wrench which can be used either as a pipe wrench or for turning nuts. The wrench is self adjusting from about one-half inch to about a two-inch tap or nut, is so constructed that it has no weak parts to spring or to get out of order, and can be made in different sizes to suit a particular purpose.

INKSTAND.—J J HOEY, New York, N Y The aim of this inventor is to produce an ink stand enabling the ink to be readily accessible to the pen whatever may be the quantity of the ink in the stand, and to provide an arrangement whereby the position of the inkstand can be adjusted to suit the quantity of ink which it contains. Mr Hoey has invented another stand of the mountain or reservoir type in which he provides means for preventing the overflow cause by numerous and well known difficulties He also provides means which will facilitate the filling of the reservoir.

Heating and Lighting.

LAMP-SHADE HOLDER.—J CRUIKSHANK, Shamokin, Pa This invention relates to improvements in shade holders, and more particularly to a construction for facilitating the attachment of the shade holder to the socket of an incandescent electric light It avoids the use of screws, bolts, or other similar fastening members, and the necessity of relying entirely upon the resiliency of the metal.

BOILER.—J G HAYDEN, New Lexington, Ohio. The aim of the invention is to provide a boiler for use in heating water for dwelling houses and the like, which includes a burner especially adapted for the use of natural gas, which can be easily regulated to insure efficient combustion by means of which water can be readily heated and which is compact in form

WATER HEATER.—A F MILLAN, Mannington, W Va This heater comprises a stand pipe at the bottom of which any source of heat such as a common burner may be arranged. This pipe is surrounded by a casing at the top and bottom of which water connections are provided for the inlet and outlet of water to be heated The stand pipe forming the flue of the burner is corrugated radially to provide an increased radiating surface and to divide the water into a series of thin flues.

Household Utilities.

BED-COVER SUPPORT.—E. D PEERSTONE, Chicago, Ill This invention pertains to a device, the purpose of which is to support the covers of a bed at the foot of the bed so as to relieve the feet from the weight of the bed clothes. The device is particularly useful as an attachment to the bed of an invalid, and it is also useful in summer to keep the feet cool

VENTILATOR.—R M HILL, New York, N Y This invention relates to ventilators adapted to be detachably secured to the window casing, so that the window may be opened a short distance to permit the entrance or escape of air, and, at the same time, to prevent direct drafts or strong currents, and to prevent the admission of rain, hail, snow, sleet and foreign bodies.

IRONING-BOARD.—ANNE M GARMAN, La Beau, S. D The intention here is to provide a main frame of clothes-horse, upon which clothes may be hung after ironing, and to this frame attach folding arms, provided with ironing boards and nets, in which the clothes may be placed before ironing One ironing board may be used for larger pieces such as sheets and table linen, while the other is used for smaller work.

HAIR-CURLER.—W M. WILLMAN, Mahanoy City, Pa. This invention is for use for curling the hair of women and children. The aim is to produce a device which can be readily applied when in practical use Instead of making the device of round cross section it may be made angular or square, so as to produce a wave effect in the hair

Machines and Mechanical Devices.

PIPE-PULLING MACHINE.—C D SHORTS, Foxburg, Pa. The aim of this inventor is to provide a machine having an extensible mast which is adapted to fold down upon the frame of the device, the entire structure being mounted upon wheels, so that it can be readily moved to and from the localities of the oil or artesian wells.

PIANO-CASING.—F. REYER, New York, N. Y. In this patent the improvement refers to pianos and the aim is to provide a piano casing, having a mechanism for simultaneously opening or closing the front fall, the back fall, the panel and the top of the piano, on the operator pressing an auxiliary pedal.

COPY HOLDER.—B F PARTS, Moro, Ore. The object of this invention is to provide a copy holder in which the copy is automatically kept in the operator's sight while at the same time being securely held in a convenient position in such a manner that it cannot be blown about or otherwise disturbed A further object is to provide a holder which can be readily attached to the standard makes of typewriters without the necessity of dismantling the machines.

FILLING AND CROWNING MACHINE.—L. LITTY, Baton Rouge La This machine receives bottles of different heights Means provide for a charging cylinder to be brought into air tight engagement with bottles to be filled, and a gaged quantity of liquid to be delivered to the discharging cylinder and thence to the bottle placed to secure it and while filling a cap is placed in position to be carried over the mouth of the bottle, and on being filled the cap is carried over the mouth of the bottle and is crimped or clamped to the neck

FLYING MACHINE.—L. C. KINCANNON, Seabright, Cal. This machine is of the so-called rotary wing type It comprises two or more pairs of wings each pair being composed of six separate wings. The wings are mounted to revolve about an axis, and also caused to be intermittently rotated, so that for a portion of their travel, they will be in a plane parallel with the general plane or direction of motion of the machine

FISH SCREEN.—W B ERICKSON Salt Lake City Utah The purpose is to provide a self cleaning screen for use in hatcheries irrigating ditches, and any small stream and so placed and constructed as to effectively prevent fish from passing through the screen and meeting destruction when the water supply is diminished or cut off It also continually carries moss, leaves twigs, and all debris over the tops of the screen and deposits them in the stream below, thereby preventing the backing up of any debris against the screen.

WASHING MACHINE.—J H BULLOCK Logan, Utah Specifically the improvement consists in the provision of a rotatable rubber mounted upon the lid or cover of the tub and adapted to engage the tub supporting standards, so that as the tub is oscillated the rubber is oppositely oscillated to effect the rubbing or cleansing action between the corrugated tub bottom and the rubber the latter having a rotatable part which facilitates this action

WELL-PUMP.—A N BLAZER Mescalero, New Mex. The object of the inventor is to provide a well pump adapted to be lowered into the well to any desired depth, and having spiral intersecting pistons rotating in unison in the intersecting bores of a pump casing the casing being open at the top and bottom and fitting the well one of the pistons being driven from above ground so that the pistons named cause the water to be lifted to any height the water passing through the pump freely, and without spraying, whirling or abrupt deflection, thereby reducing the friction of the water to a minimum

CAR HANDLING MECHANISM.—A J LA FAYETTE, JR., Pittsburg, Kan This invention provides means whereby loaded cars are automatically run upon an elevator cage used for hoisting in mine or other shafts, provides an automatic mechanism for delivering said cars to the cage, and for releasing any empty cars therefrom which may have been lowered with the cage, and provides a means whereby the functions of the mechanism are performed

STEAM TRAP.—G C ELLERTON Portsmouth, Va This invention pertains to improvements in automatic steam traps for the discharge of the accumulated water of condensation One of the objects is to provide a device in which the accumulated water can be discharged as fast as it enters the trap without the necessity of providing a by-pass.

Prime Movers and Their Accessories.

ENGINE.—P O POULSON Brigham, Utah Mr Poulson utilizes two pistons within each cylinder and so connects these pistons that they will move simultaneously in opposite directions from the center The pistons instead of being connected to a crank shaft are connected by gears to a pinion on the main shaft, so that the movements of the pistons in opposite directions will simultaneously tend to rotate the shaft in the same direction. It tends to a large extent to eliminate vibration of the engine.

STEAM ENGINE.—E. GARST, Dayton, Ohio In the present patent the invention relates to single-cylinder reciprocating steam engines and the object is to provide a new and improved steam engine, arranged to insure an easy and uniform running under varying loads, and to allow adjusting of the engine according to the work and to cause the engines to run in either a forward or a backward direction

ROTARY ENGINE.—D CONKRIN Tampa, Fla The object here is to provide an engine wherein a pair of pistons are geared together by means of the blades or vanes intermeshing, wherein the motive fluid is directed squarely against the operative face of the blades, and wherein the fluid will act on the blades with equal facility in either direction.

ENGINE.—J A DOWLING, Biloxi, Miss. In this instance the intention is to provide a new and improved engine, in which the motive agent is introduced between two pistons reciprocating in headless cylinders, to utilize the motive agent to the fullest advantage and to allow of compounding the engine in a simple and efficient manner

INTERNAL COMBUSTION ENGINE.—L F SLEADE, Denver, Colo. The object of the present invention is to provide an internal combustion engine more especially designed for use in tunneling and other machines, with a view to cause a cutting tool to deliver or strike blows on rocks or other material, without injury to the operating parts of the engine

Railways and Their Accessories.

SIGNAL.—C P RUGGLES, Sedalia Mo. This invention relates more particularly to such signals as are adapted to be used in connection with the operation of railroads and which consist of casings having compartments and spring actuated, sectional targets arranged within the compartments, the former being adapted to assume an extended position for display when released from the compartments

MAIL-BAG CATCHER.—J A SCHINNER, Greenfield Ohio. The purpose here is to provide details of construction for a mail-bag catcher that adapt it for reliable service either to catch a mail bag and deliver it at the open door of a mail-car on a moving train or transfer a mail-bag from a train in motion to a station at the side of the track on which the train is moving.

RAILROAD-RAIL JOINT.—H NABLEFELD, Monico, Wis. This invention refers to means for connecting together the meeting ends of rails, and the purpose is to provide novel details of construction for the track rails of a railroad, which will effect a proper alinement of the rails and compensate for their expansion and contraction due to exposure to heat and cold.

CAR-FENDER.—J F CARRAHER Heath Mass. An object of this invention is to provide a car fender having a movable portion so that when a person is struck by the fender the movable part will operate to close the space between the ground and the normal position of the fender thereby preventing the fender from riding over the person and also serving as a protection to the wheels.

GRAIN-CAR DOOR.—J E FAUCETT Kenmare N D The main object of this improvement is to provide a door which may be easily opened after the car has been filled with grain notwithstanding the pressure exerted by the grain itself In fact the pressure of the grain upon the door facilitates the opening of the latter

REFRIGERATING-CAR.—J THORNTON and E. HEYMANSON, New York N Y The invention contemplates the use of refrigeration apparatus, such as ammonia machinery in which the cooling water for the condenser is kept at a sufficiently reduced temperature to do this work by a special construction and arrangement of the tank in which it is normally held, so that the surface of the tank is exposed to the rush of air developed by the motion of the car

RAIL-JOINT.—W H FRENCH, Evansville Ind In constructing this joint by which the jarring incident to the hammering of the wheels is substantially eliminated the adjacent ends of the rails are provided with a common transverse opening or slot in which are placed two curved plates with the concave faces of the plates facing inwardly and means tending to flatten and expand the plates to bind against the upper and lower edges of the opening

WRECK PREVENTER.—E B POOLE, Delmar Ala In the present patent the object of the improvement is the provision of a device capable of being attached to any locomotive or railroad car, and which will grasp a third rail beneath the tread thus effectually preventing the wheels from leaving the track

Pertaining to Recreation.

CUE.—H McCLEARY Washington, D C This invention is an improvement in cues for use in playing billiards and similar games and particularly in the tip holding devices for use on said cues. The construction is simple inexpensive, facilitates the application and removal of the cue tip and enables the substitution of a new tip instantly and without the aid of skilled labor

TOY PISTOL.—M J SHIMER, Bethlehem Pa. In this automatic pistol caps in the form of tape are fed under the hammer at each pull of the trigger and means retain the hammer and cap-feeding finger in position to enable ready insertion of the tape over the feeding plate and anvil when the tape is renewed Means lock and unlock a cap chamber cover on its seat and return the hammer and the finger named when released and press it to the feed plate by means of a single spring

CONTAINER FOR FISHING APPARATUS.—J M ELLSWORTH Bernardsville N J This invention involves an improved container for use in carrying flies and their attached leaders used in fishing, and the object of the invention is to so construct the container that the flies will remain dry while the leaders and the connections between the leaders and flies will remain moist.

Pertaining to Vehicles.

SPRING WHEEL.—A. B. Miskin, Idaho Falls, Idaho. This inventor has for his object the provision of a wheel wherein the hoop or rim of the wheel itself is resilient or pliable so as to act in the capacity of a spring. In this way, the jars and jolts are taken up by the spring rim of the wheel and no other springs are necessary.

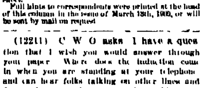
WRENCH.—J. I. Powers, Hot Springs, Ark. This invention is an improvement in wrenches. The wrench is especially designed for use in wagons for the wheel nut and efficiently serves the purpose for which it is designed. The cross bolt has a squared portion adjacent to its head and the opening receiving the said square portion is correspondingly formed to prevent the turning of the bolt.

AUTOMOBILE STARTER.—C. A. Smith, Brattleboro, Vt. The invention relates to starting devices for automobiles, by means of which the regular starting crank as commonly used may be dispensed with and the device may be operated by the driver without leaving his seat. The pedal may be locked in position by a latch which can be released only by retarding the spark lever to the proper point for cranking the engine.

ROAD SMOOTHING DEVICE.—F. W. Lechner, Wenona, Ill. The device is adapted to be drawn over wagon roads, or by attaching them to ordinary vehicles or to vehicles especially designed for the purpose. This type was shown in a prior patent granted to Mr. Lechner. An object of the present patent is to provide a device which may be adjusted angularly to direct the dirt toward the center or toward the side of the road.

BRAKE CONTROLLING DEVICE FOR BICYCLES.—B. Pérocasse, Lyon, France. The device enables the rider to produce a graduated pressure of the friction brake upon the tire and thus control with ease the progressive movement of the wheel when coasting and further the device is constructed so that slackness in the brake setting cable can be taken up at any time by an adjustment of parts and thus maintain the brake in proper condition for effective operation.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th, 1909, or will be sent by mail on request.

(12211) C. W. O. asks: I have a question that I wish you would answer through your paper. Where does the induction come in when you are standing at your telephone and can hear folks talking on other lines and from other towns? One can hear this when the lines run in opposite directions. The telephone companies here claim that it is the wires running along side by side for some distance, when in this case the sound of words spoken jumps across from one wire to the other. Now what I think about it is that it is at the central station. I notice at these places that they sometimes have put one ground wire to which they hitch all the lines that come into town. I hold the ground that this is where the most induction comes in. Am I right? Can this induction be heard if every line entering central had a grounding of its own before entering? Does it weaken a telephone system to be able to hear the talk at the same time all over the country? A. The cross talk in the telephone is ordinarily caused by the induction of electric currents flowing in wires near to the wire to which your telephone is connected. No sounds flow over the wires. Only electric currents pass from telephone to telephone. These cause a vibration of the receiver which you hear as a sound. These currents pulsate as waves around the wire which is transmitting them. These waves are very much like the waves which are used in wireless telegraphy, but are less intense. They can however affect a wire quite a number of feet away and cause a person to hear in his telephone what they are carrying to their own telephone. The process of thus affecting a wire with which the current has no direct connection is called induction. It is not necessary to call the ground wires into the case to explain the action. Such currents do not injure the instruments at all. They are very annoying when they mix up with what one is saying and prevent distinct hearing. They are prevented by the use of a metallic return circuit of twisted wire, as is done in all cities and large places.

(12212) F. E. W. asks: I desire to purchase a reliable hygrometer for indoor and outdoor use. What make of hygrometer would you recommend and where can it be purchased? A. All the so-called hygrometers are simply indicators, and are not scientific instruments giving a measurement of the humidity of the air. The instrument employed in the Weather Bureau consists of two thermometers on the same base, one having water constantly evaporating from its bulb, and the other having a dry bulb. These you can get through the Weather Bureau, Washington, D. C., and from tables you can determine the humidity correctly. They will not cost much more than the so-called hygrometers, and are reliable.

(12213) C. C. asks: If an air-tight tank one cubic foot square, made of material the same weight as water, were submerged to a depth of fifty feet in still water, what would be the pressure of the water on the two top sides, the two bottom sides, and the two ends, separately, the tank to sit with one edge up? What would be the pressure of the tank upward if released and would the pressure diminish any the nearer it came to the surface? If so, at what rate? If you turn the tank flat on its side, would the pressure upward be as great? If not, how much difference? A. If a box one foot on a side is sunk in water, it displaces one cubic foot of water. Each side is a square foot. At a depth of fifty feet each side is pressed upon by a column of water one foot square and fifty feet high, which weighs about 50 x 62.5 pounds. As there are six sides, the total pressure on the box is six times the pressure on one side. It makes no difference how the box lies in the water, since the pressure under water is equal in all directions and perpendicular to any surface. The upward pressure of the water is greater than the downward pressure of the water by the weight of the water displaced, which is the weight of one cubic foot of water. This for fresh water is about 62.5 pounds and does not vary with the depth. Now if the box is of the same weight as water it will not tend to rise or sink at all, but will remain at any depth at which it may be placed. This is in accordance with Archimedes's principle, which is given in all text books of physics.

(12214) D. R. asks: Will you kindly explain in inquiry column how the moon can complete one rotation on its axis in the same time that it makes a circuit of its orbit, all the while presenting the same hemisphere to the earth. I can readily understand it faces the four cardinal points of space in its circuit, but fail to see any indication of axial movement. A. Whether one considers that the moon rotates on its axis or not depends upon the point of view. As seen from the center of the earth, it does not rotate on its axis; as seen from the sun it does. Astronomers are agreed in considering the matter as if viewed from the sun, and all astronomies state that the moon rotates once in a revolution. It presents all points of its surface toward the sun each month. The moon really revolves around the sun in company with the earth. Its orbit is always concave to the sun, and moon and earth swing to and fro as they go, the center of gravity of the two moving around the sun in the ellipse which we speak of as the earth's orbit. You will find this in almost any astronomy. See Todd's New Astronomy. If you will try a lamp and a globe as described in Todd's book you will see that you must turn the globe on its axis in order to keep it with the same face toward the lamp in the center as you carry it around the lamp.

(12215) R. S. asks: I am going to install electric lights in my farm home and use water power. I have a stream near my house that by damming I can get a fall of 10 feet. It has a flow of 125 feet a minute and will run a 6-inch pipe full and a little to spare the year round. I have been told that it will furnish about 4 horse power and I believe that it would be an ideal power for lighting my home, a house of ten rooms. I am going to buy a direct current dynamo and the wires, etc., and wish to make my own water wheel. I inclose 40 cents for which please send me four of your Supplements which in your opinion would be useful to me in making an overshot water wheel or a turbine. I am in a position to make either kind, for I have a workshop of my own. I am going to use a 1½ kilowatt generator and about 30 32 candle-power tungsten light. You may use your own judgment in selecting these Supplements for me, knowing that you have had numerous calls like mine. Anything that will be of information to me will be thankfully received. A. We would advise that it is necessary to allow 1.7 horse power per kilowatt in small plants, so that your 1.5 kilowatt generator should have about 2.5-horse-power in the water wheel to drive it. The 32-candle-power tungsten lamps require 40 watts each, and thirty of these lamps will require 1,200 watts, which will call for a little more than 2-horse-power at the water wheel. If you will not require all the lamps at one time it may be that you can get along with 1 horse-power at the water wheel. You should therefore, have ample power even if we understand you correctly that the flow of the stream is only 125 cubic feet per minute. That quantity of water with a 10-foot fall will generate theoretically 2.37-horse-power, of which you should be able to obtain 80 per cent or better in actual useful work with an efficient Pelton or similar water wheel. From your remark, however, that the flow is sufficient to keep a 6-inch pipe running full, we should say that you probably have more power. One hundred and twenty-five cubic feet per minute represents the flow through a 6-inch pipe with a fall of less than 1 in 10, and if your pipe was placed with a sharper fall when you made the measurement, the flow may be greater than you suppose. If the pipe was placed with a fall of say 1 in 2, and ran full, the flow would be nearly 300 cubic feet per minute, giving you more than twice as much power, or if it ran full with a fall of 1 in 1, over three times the power.

(12216) C. W. S. asks: Will you please answer the following questions: 1. What metal or metal alloy has the lowest melting point? A. You will find a long list of fusible alloys in Kent's Mechanical Engineer's Pocket Book, which we send for $5 post paid. The one having the lowest melting point as given there is Darcet's with mercury. It is made of bismuth 50, lead 25, tin 25, mercury 250 parts, and is said to melt at 113 deg. F. Wood's alloy is made up of bismuth 50, lead 25, tin 12.5, cadmium 12.5 parts, and is said to melt at 140 deg. F. 2. Have any estimations been made recently on the speed of light, and also electricity? I saw in a certain paper a statement to the effect that light travels 192,000 miles per second and electricity 288,000, whereas I always thought they both traveled 186,500 miles per second. A. The speed of light and electricity through space is 186,300 miles. The best measurements are those of Michelson and Newcomb, described in our Supplement No. 557, price 10 cents. You are correct in your idea that the two, light and electricity, come together from the sun. The number you quote, 288,000 miles, was given a good many years ago and was due to erroneous ideas about the matter.

(12217) T. H. says: Suppose the moon to be 240,000 miles from the earth in round numbers. Its orbit will then be 720,000 miles. The diameter of the moon being 2,000 miles it would require 360 moons in contact side by side to extend around the complete circle of the orbit. Now as there are 360 degrees in a circle and 360 moons in contact would extend around the moon's orbit, why does it not follow that a diameter of 2,000 miles at a distance of 240,000 miles is just one degree? The astronomers say the moon really is from 28 min. to 33 min., or about ½ of one degree. I had as well say that I am aware that the moon is something over 238,000 miles away, is over 2,100 miles in diameter, that its orbit is an ellipse and that Pi is not exactly 3 to 1. I have given round numbers for convenience. A. If the data regarding the moon were as you give them the results would be as you calculate, but since the data are not as you give them the results are too far from the actual to be of any value. The moon varies in its distance from the earth from 221,000 miles to 252,970 miles. The circumference of her orbit cannot then be calculated in terms of a circle. The mean diameter of the moon is 31 min. 8 sec., and this varies more than 2 min. This is found by direct measurement by astronomers with the micrometer eyepiece of the telescope. That is first hand data. The moon's diameter in miles is 2,153, quite too much more than 2,000 miles to be put into round numbers in that way as a basis of a Why does it not follow? It would follow as we said above, if it were so.

(12218) E. E. K. says: After consideration as to whom I could apply I shall trespass upon your time to ask if no legal responsibility would attach to discomfort or danger through a passageway being "sealed up" (virtually) in a water tight compartment on an ocean steamer. Fortunately I have no personal complaint of such to make, but my attention was called to it last year when some passengers found themselves so shut up at night, one of them (ladies) being ill. In this case they found a rambling exit up a small back stairway, and so emerged through the large dining room. Upon further consideration of the matter I scarcely think I am mistaken in supposing that some of these compartments with nine or twelve staterooms are completely cut off, even first class passengers. In the case of steerage I do not suppose life would be worth considering. I heard of one instance where a gentleman upon going down late found the only way to his berth through the ladder on the smokestack. In view of the awful possibilities and of the great stress laid upon free exits on land this appears to me an important issue. A. Correspondents should observe the rule that street address, names of cities and States should be given in full, as otherwise it causes us much trouble. Your question is a peculiar one. Most of the modern bulkhead doors are kept normally open, and are only closed hydraulically or electrically when there is an accident, such as a collision or stranding. There are bulkhead doors above the water line which are to be closed by stewards in case of emergency. It is impossible to give any exact answer to your letter without knowing the boat. The mutilated diagram showing ship's cabins would not indicate that there were any bulkheads which were normally to be kept closed, although there appear to be several fire bulkheads for use above the water line. These doors would be kept normally open. We do not think you are well informed in stating that nine to twelve staterooms would be entirely cut off without access to a companionway. "Great attention is paid to the life of every passenger at sea, as will be seen in an important book which will shortly be issued, entitled the "Scientific American Hand Book of Travel," in which some thirty to forty pages are devoted to "Safety at Sea." One is as safe at sea as in a trolley car or railway car in this country. The writer is entirely familiar with steamers of all classes which are licensed to carry passengers, and he is unacquainted with any such condition as you outline.

NEW BOOKS, ETC.

The Human Race. Its Past, Present, and Probable Future. An essay by J. Samuelson. London: Swan Sonnenschein & Co., Ltd., 1910. Pp. xii + 192.

In the preface to his book Mr. Samuelson states that his aim has been "the embodiment of the experiences and results of an octogenarian." He outlines briefly the changes which have taken place in the nature, belief, and activities of mankind from the earliest period down to the present day. If the book has any fault it is that of dwelling too much upon the emotional, physical, and intellectual man. The few references to inventions to be found under the heading of 'Man's Mental Progress' can hardly be considered so much an evidence of heightened mentality as of improvements in exterior conditions. The improvement of exterior conditions does not necessarily mean development of the intellect. The later phases of evolution and their influence upon mankind are not discussed, though it cannot but be admitted by every thinking man that the revival of Mendel's law of heredity and its application as well as the modern views of eugenics, undoubtedly have their bearing upon this subject. On the whole, however, the book must certainly serve the purpose for which it was written, namely, that of "stimulating inquiry and serious study."

Taschenbuch der Kriegsflotten. Mit einem Anhange: Die Luftkriegsschiffe. XI Jahrgang 1910. Herausgegeben von Kapitänleutnant a. D. B. Weyer. München: J. F. Lehmanns Verlag. Price, $1.50.

Capt. Weyer's excellent handbook follows the general arrangement of his previous annuals. The remarkable development in the English, German and American fleets during 1909 are all accurately calculated. The most novel feature of this year's handbook is an illustrated appendix on the developments of aeronavigation in 1909, particularly with reference to the military and naval value of aero-locomotion.

Indian Insect Life. By H. Maxwell Lefroy, M.A., F.E.S., F.Z.S., assisted by F. M. Howlett, B.A., F.E.S. Calcutta and Simla: Thacker, Spink & Co. London: W. Thacker & Co., 1909. 4to., 786 pp.

This is a manual of the insects of the plains of tropical India. It is beautifully illustrated and is a rather remarkable production to be printed in Calcutta. The subject is rather a special one and we do not feel competent to pass an opinion on it. The work seems to be a thoroughly scientific one and the plates are certainly very creditable. They are numerous and well executed.

Light. By Richard C. Maclaurin, President of the Massachusetts Institute of Technology. New York: Published by the Columbia University Press, 1909. Price, $1.50.

During the winter of 1908-9 Dr. Maclaurin delivered a series of ten lectures before the American Museum of Natural History on the salient features of the modern theory of light. Written primarily for the intelligent man who lays no claim to scientific knowledge, but wishes to keep abreast of the scientific times, this book serves admirably to show how wonderfully the modern theories suit the facts down to the minutest numerical detail. The subjects treated are the following: Early Contributions to Optical Theory, Color Vision and Color Photography, Dispersion and Absorption Spectroscopy, Polarization, The Laws of Reflection and Refraction, The Principle of Interference, Crystals, Diffraction, and Light and Electricity.

Radford's Garages and How to Build Them. Selected and compiled by William A. Radford. Chicago and New York: The Radford Architectural Company, 1910. Pp. 108, 55 designs. Price, $1.

This collection of garage designs contains many new, original, and artistic examples of up-to-date private and public structures for the housing of automobiles, and permits considerable latitude in the choice of material to be used in the construction. The various designs include the use of wood, brick, stone, cement, stucco, and concrete. The compiler, as president of the Radford Architectural Company of Chicago, and the author of various books on architecture and building, is well qualified for the work he has undertaken in the present volume. Many of the designs are of pleasing architectural novelty and are adapted to the various requirements of up-to-date construction, and the latest approved materials used in modern building practice. Nearly sixty different garage designs are illustrated, and the construction cost ranges from [illegible] to [illegible] the smaller [illegible]

the larger private garages, while the public buildings of this kind, equipped with the latest approved modern accessories and conveniences, run in cost from $8,000 to $11,000

The book also includes a useful section covering garage equipment and accessories. This division illustrates a number of novel and useful appurtenances for different purposes in the garage itself

TELEPHONOLOGY By H. R. Van Deventer, B.S., E.E. New York McGraw-Hill Book Company, 1910 Pp 586, 682 illustrations. Price, $4

The author is to be congratulated on preparing a very complete description of modern telephone appliances. It takes up the subjects in detail, explaining not only what the instruments are but how they are constructed, what repairs they are liable to need, and how to remedy the troubles that so frequently beset telephone systems. The book does not describe all types of telephones nor go exhaustively into the history of the telephone but is confined to the modern practical telephone and all instruments accessory thereto. The work is not entirely written by the author but contains in addition a number of special articles on various subjects written by experts in those particular lines. The book closes with a chapter on wireless telephony, thus bringing the subject up to date Of particular value to the telephone engineer are the remedies given for various switch board and other troubles. The book is one which no practical telephone man can afford to do without

MAVER'S WIRELESS TELEGRAPHY AND TELEPHONY By William Maver, Jr Maver Publishing Company, 1910 8vo, 366 pp, 258 illustrations Price, $3.

A number of years ago the author of this book wrote an appendix to his Encyclopedia of American Telegraphy" dealing with wireless telegraphy This appendix subsequently grew into a book and we have here the fourth edition which has now expanded greatly The first part of the book relates to wireless telegraphy and bringing the subject to date The second devoted to wireless telephony is possibly more interesting for the reason that the art of talking by means of Hertzian waves is still in its earliest infancy

ELEMENTS OF PHYSICS For Use in High Schools By Henry Crew Professor of Physics, Northwestern University Revised by Franklin T Jones, Teacher of Physics, University School Cleveland New York The Macmillan Company, 1909 435 pp, 357 illustrations

Experimental physics has become such a feature of the present day high school course that we cannot have books enough on the subject. The aim of the author in the present work is to provide the teacher with a textbook which will take up the subjects of mechanics sound, light heat and electricity, not disconnectedly but as a related series. The book was originally published in 1899 by Prof Henry Crew, but owes its present form to the work of Mr Franklin T Jones, who has arranged it particularly for the high school student The matter contained in the book furnishes the teacher with the fundamentals of physics so arranged as to be within the comprehension of the average pupil sixteen years of age.

THE CONQUEST OF THE AIR. The Advent of Aerial Navigation By A L. Rotch, S B, A.M New York Moffat, Yard & Co, 1909 12mo, 192 pp, 35 illustrations. Price, $1 net

Particular interest attaches to this book because of the excellent meteorological work done by the author at the Blue Hill Meteorological Observatory Some of this work is described in the opening chapter on "The Ocean of Air," which goes into the subject of sounding the air to find the prevailing air currents, air pressures etc. The book then commences with a history of aerostation and thus leads up to the latest types of flying machines. The author also gives us his ideas of the future of aërial navigation in the final chapter of the book

PRODUCER GAS FIRED FURNACES By Oskar Nagel, Ph D New York Published by the Author, 1909 8vo, 192 pp; 237 illustrations. Price, $2 net.

More energy can be obtained from coal when used in a producer gas plant than in any other way The increasing interest in this method of utilizing the energy of coal should make the present work of particular interest. The book gives detailed descriptions and practical illustrations of all kinds of gas fired furnaces and describes actual installations of furnaces used in chemical, metallurgical, iron, steel, lime, cement, glass, brick, and ceramic industries.

PRACTICAL TESTING OF ELECTRICAL MACHINES By Leonard Oulton, A.M I.E.E. and Norman J Wilson, M.I. E.E. New York Whittaker & Co., 1909. 16mo; 210 pp; 90 illustrations. Price, $1 40 net.

The various tests which are made on electrical machines are here presented in pocket book form for the convenience of engineers and students. The matter is, of course, somewhat condensed, but nevertheless the book is a practical manual adapted to supplement the standard textbooks. It takes up tests on induction motors, alternating current generators, rotary converters and synchronous motors, also single phase railway motors. There are four chapters on direct current motors and generators. Altogether the book will be found most useful to the practical man as well as the student.

HIGH FREQUENCY ELECTRIC CURRENTS IN MEDICINE AND DENTISTRY Their Nature and Actions and Simplified Uses in External Treatments. By S H Monell, M D New York William R. Jenkins Company, 1910 8vo., 465 pp., 23 plates Price, $4 net.

The author describes in detail how he has used high frequency currents in medical treatment and dentistry, explaining in detail how he applies the treatment for specific ailments.

PRACTICAL ARMATURE AND MAGNET WINDING. By Henry C Horstmann and Victor H. Tousley Chicago Frederick J Drake & Co, 1909 16mo, 231 pp, 128 illustrations. Price $1.50

This book is intended for the practical electrician and aims to supply sufficient information about the theory of armature winding to enable him to understand the advantages of certain methods employed in actual practice and the necessity of certain precautions. The authors have aimed to eliminate all irrelevant matter and adhere closely to their motto to supply 'everything that is needed and nothing that is not needed'

THE CALCULUS AND ITS APPLICATION By Robert Gordon Blaine, M E. New York D Van Nostrand Company, 1909 12mo., 321 pp Price, $1 50 net.

The use of the calculus has come to be of such importance in engineering work and particularly in electrical work that it is necessary for many who were unable to take up this subject in college days to study calculus by themselves. The present work is well adapted to home study as it is written in a very clear style, the various steps being explained thoroughly and illustrated with examples. The book is primarily intended as a textbook for school use and is compiled from notes and examples prepared by the author for his own classes.

VON PFLANZEN ZWISCHEN DORF UND TRIFT Von Dr Ad Koelsch Stuttgart Kosmos, Gesellschaft der Naturfreunde, Geschäftsstelle Franckh'sche Verlagshandlung Pp 93 Price, 50 cents

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Properties of Polonium.

BY PROF. B. BOLTWOOD.

Polonium was the first of the active substances separated from pitchblende residues by Mme. Curie. Various methods of concentration were devised by her with the result that preparations of polonium mixed with bismuth were early obtained many thousand times more active than uranium. Marckwald later separated from 15 tons of pitchblende about 3 milligrammes of intensely active material which he called radio-tellurium, since it was separated initially with tellurium as an impurity. By dipping a copper plate into a solution of this substance, he obtained a deposit of weight not more than 1/100 milligramme, which was far more active than an equal weight of radium. It was soon recognised that this preparation was identical with polonium, for it gave off the typical α radiation, and had the characteristic rate of decay of that substance. Unfortunately, Marckwald was not aware at the time of separation of the great importance of testing whether lead appeared as a product of transformation of polonium. Before such an experiment could be made, the polonium had to a large extent been transformed.

Polonium is one of the numerous transition elements produced during the transformation of the uranium-radium series. It is half-transformed in about 140 days, emitting α particles during the process. Rutherford showed in 1904 that polonium was in reality a transformation product of radium itself. Radium at first changes into the emanation, and then successively into radium A, B, C, D, E, F, radium F being identical in all respects with the polonium directly separated from a radio-active mineral. When the radium emanation is allowed to decay in a sealed glass tube, the walls of the tube are coated with an invisible deposit of pure radium D, radium E, and radium F, but the amount of the last to be obtained in this way is far too small to be weighable.

The amount of polonium present in any radio-active mineral can easily be calculated. Since the radium and polonium (radium F) in a mineral are in radio-active equilibrium, the same number of α particles are expelled from each per second. Since polonium is half transformed in 140 days and radium in 2,000 years, the former breaks up 5,000 times faster than the latter. The maximum amount of polonium to be obtained from a mineral is in consequence only 1/5,000 of the amount of radium. In 1,000 kilogrammes of pitchblende containing 50 per cent of uranium, there are present 170 milligrammes of radium. The weight of polonium is about 1/5,000 of this, or about 1/30 milligramme. It is thus obvious that to obtain 1/10 of a milligramme of pure polonium, several tons of high-grade pitchblende must be worked up. The most natural source of polonium is radium D (radio-lead), which grows polonium and has a period of half transformation of about twenty years. Since polonium breaks up about 5,000 times faster than radium, its activity, weight for weight, should be about 5,000 times greater than that of radium. There is nothing surprising in this, for the radium emanation has an activity about 200,000 times that of radium, while radium A (period three minutes) must have an activity 400 million times that of radium itself. Since the radiation from polonium is entirely in the form of α rays, it is to be expected that the radiation from it would show chemical and physical effects identical with those observed for pure emanation, the only difference being that the products of the latter emit β and γ rays as well.

Apart from the interest of obtaining a weighable quantity of polonium in a pure state, the real importance of the present investigations of Mme. Curie lies in the probable solution of the question of the nature of the substance into which the polonium is transformed. [illegible]

[illegible] Since polonium emits α particles, [and] its products of decomposition, as [do] all the other α-ray products, should [be] helium. The production of helium from a preparation of polonium has been observed by Rutherford and Boltwood (Manchester Lit. and Phil. Society, November 30th, 1909), and also by Mme. Curie and Debierne in their present experiments. Boltwood several years ago suggested that the end product of the radium series was lead, and has collected strong evidence in support of this view by comparing the amount of helium and lead in old radio-active minerals. Since polonium is the last of the active products observed in the radium series, it is to be expected that polonium should be transformed into helium and lead, one atom of polonium producing one atom of helium and one atom of lead. This point of view receives additional weight from consideration of the atomic weight to be expected for the end product of radium. Since in the uranium radium series, seven α particles, each of which is an atom of helium of atomic weight four, are successively expelled before radium F is reached, the atomic weight of polonium should be $7 \times 4 = 28$ units less than uranium (atomic weight 238.5). This gives an atomic weight of polonium of 210.5, and after the loss of an α particle, a final product of atomic weight 206.5—a value very close to the atomic weight of lead.

It is a matter of very great interest and importance to settle definitely whether polonium changes into lead. The evidence as a whole has long been in favor of that supposition. The outlook is very promising that the experiments of Mme. Curie and Debierne will settle this question conclusively. No doubt an interval must elapse to allow the polonium to decay before the final examination of the residual substance can be made.—Nature.

The Revolving Safe.

The revolving safe is the latest advance of the safe industry in its continuous contest with the burglar, who, in the most recent times, has taken to working with the cutting burner, which, by means of an oxyhydrogen or oxyacetylene flame, can cut through the heaviest armored safe in a few minutes. The revolving safe makes the employment of the cutting burner absolutely impossible. It consists, as Technische Rundschau describes it, of a steel strong box, closed on all sides, of polygonal section, arranged to revolve on ball bearings, and inclosed in a spherical compartment, built of strong masonry and closed above and below with masonry, in such a manner that the steel strong box can revolve on its vertical axis, without coming in contact with the walls. In the inclosing masonry and in the strong box, doors are contrived, by means of which the strong box is accessible from outside, as long as it is not revolving, which would be the case for instance during the business hours of the bank in whose quarters the revolving safe is set up. At the close of business, both doors are closed, an electromotor, operated by a storage battery, is switched on and the strong box then revolves at a uniform rate of speed uninterruptedly until a predetermined period, to which a clockwork connected with the switching apparatus is set, when the moving mechanism is automatically switched off.

While in revolution, the strong box is absolutely unassailable. The electric motor and the storage battery are placed inside of the steel chamber, cannot therefore be tampered with from outside; any interruption of the revolution, no matter how effected, and any decrease in the speed of the revolutions, is announced at once, with the aid of alarm devices, and if the safebreakers should have succeeded, at any point, in breaking through the [illegible] masonry, they cannot attack the [illegible] strong box, not even [illegible] burner, because, in con-

([illegible] on page [illegible])

(Concluded from page 288)

Shells in shell holders, machine for assembling, H. Stillwell 952,477
Shingling and clapboard gage combination straight-edge, C. H. Webster 952,772
Ships' hulls and the like, cleaner for, W. R. Macdonald 952,455
Shoes, resilient tread and reinforcing spring for, J. H. Curley 952,600
Show case, A. Reinle 952,945
Show case corner fastening, glass, C. M. Mortensen 952,834
Shutter fastener and bower, H. Zimmerman 952,860
Shuttle changing mechanism, automatic, S. Toyoda 952,652
Sister hook, H. H. Stranghan 952,958
Smoke condensing and gas or fume absorber, P. Marron 952,902
Smoke pipe, C. R. Klein 952,816
Solids from liquids, apparatus for separating, L. C. Trent 952,500
Sound records with electroconductive material, apparatus for coating, I. W. Norcross 952,753
Spark arrester and smoke consumer, J. E. Hamilton 952,737
Spark coil, C. H. Thordarson 952,692
Speed device, change of, T. J. Kehoe 952,539
Spindle centering device, Nainteau & Rich 952,931
Spinning ring holder, rotary, R. Hall 952,804
Splice bar, A. W. Stricker 952,959
Splints, machine for assembling and screwing, L. A. Clinton 952,512
Spoke tightening device, R. Wohlermann 952,487
Spool extension, I. J. Mahl 952,708
Spray device, C. Revaillot 952,047
Sprinklers, power set for automatic, F. A. Rix 952,640
Squeezer, R. R. Gilchrist 952,519
Stacker, hay, F. Wyatt 952,480
Stalk cutter, T. A. Davis 952,727
Stamp, dating, B. B. Hill 952,738
Stamp, time, F. Purdy 952,677
Stand. See Emery wheel stand.
Starting gate for sports, W. H. Brunner 952,503
Steam engine, J. Stumpf 952,764
Steam trap, W. R. Templeton 952,489
Steam trap, Kidding & Brown 952,814
Stencil frame, F. D. Barnum 952,781
Stop and reverse mechanism, automatic, D. D. Hungerford 952,891
Strap hanger, passenger, W. B. McCarthy 952,927
Subfloating bodies, automatic depth regulating device for freely, K. O. Leon 952,472
Suction supporting device, C. A. Austin 952,495
Telegraphic circuits, apparatus for transmitting signals over, L. M. Potts 952,944
Telephone, multiplex, A. K. Young 952,557
Telephone system, D. R. Hulfish 952,587
Tenoning machine, J. Ojangurren 952,939
Testing set, C. A. Hoxie 952,741
Thread guide, I. F. Palmer 952,750
Thresher concave, M. Flynn 952,795
Threshing machine, A. W. Cameron 952,700
Threshing machine feeder, F. Hammlich 952,530
Ticket folding and cutting machine, F. Marcus 952,456
Ticket receipt, railway, W. H. Barnes 952,780
Tin plate washer, J. W. Kendrick 952,568
Tile mold, Huber & Lang 952,578
Time recorder for homing pigeons, G. M. Mills 952,832
Tire armor, vehicle, C. S. Darrell 953,000
Tire, pneumatic, L. B. Krum 952,675
Tire, vehicle, W. W. Scott 952,961
Toilet comb, F. F. Youngs 952,491
Tool, combination, Shaw & Stroup 952,478
Tool coupling, S. P. Fiter 952,802
Tool, hand, A. G. Lamb 952,570
Tool holder, F. Shapowalow 952,470
Top, S. H. Law, Sr. 952,917
Torpedo and the like, K. O. Leon 952,461
Track cleaner, F. B. Lockrem 952,463
Track drill, E. Pierce 952,466
Track fastener, C. H. Tibbetts 952,962
Trap. See Fly trap.
Tree holder, H. J. Wagner 952,005
Triangle, registering, J. Meacham 952,920
Trowel, Wolsey & Dupuis 952,971
Truck, manure, G. A. & C. J. Hiper 952,711
Truss, hernial, R. F. Lockwood 952,015
Turbine, R. H. Goldsborough 952,017
Turbine blade and vane, Loud & Potter 953,016
Turbine, elastic fluid, R. N. Ehrhart 952,792
Turbine engine, steam, E. F. Edgar 952,791
Type bar and typographic form, F. H. Richards 952,579, 952,030
Type casting and composing machines, letter spacing mechanism for, F. H. Pierpont 952,683
Type mold, Bancroft & Knight 952,600
Type molds, forming, attaching, and positioning nick pins in, Bancroft & Knight 952,598
Typewriter, J. L. McClintock 952,643
Typewriting machine, Merritt & Pomeroy 952,749
Typewriting machine, C. W. Walker 952,771
Umbrella, R. F. Bruneillo 952,804
Umbrella, F. D. Philp 952,690
Valve, H. M. Hillegass 952,523
Valve, J. G. Talmage 952,691
Valve, N. H. Burch 952,708
Valve or cock, Connors & Kitch 952,605
Valve or gate for weirs or the like, H. Buehler 952,725
Valve, throttle, E. D. Caldwell 952,508
Valve, throttle, J. R. Chambers 952,510
Vapor burners, feeding device for, L. O. T. Thompson 952,770
Vaporizer, O. F. Swain 952,648
Vegetable cutter, A. F. McGrew 952,625
Vehicle starting device, motor, A. E. Garnier 952,800
Vehicle wheel, resilient, J. Norgren 952,774
Vending machine, B. Lovatt 952,580
Vending machine, coin controlled mechanism, B. Lovatt 952,587
Vending machine for insurance policies, tickets, etc., automatic coin controlled, H. O. Jackson 952,900
Ventilator, A. Bryntesson 952,505
Ventilator, W. Lintern 952,717
Vise, combination, J. Crawford 952,787
Voting machine, J. McTammany 952,464
Wagon, H. Peterson 952,943
Wagon bed and hay rack, J. J. McIntire 952,751
Wagon bolster washer, J. A. Martin 952,748
Warm air furnace, C. E. Stewart 952,476
Washer. See Tin plate washer.
Washing machine, F. W. Krans 952,818
Washing machines, clothes pounder for, W. L. Roberts 952,641
Watch, C. H. Meylan 952,921
Water closet bowl, J. F. Kelly 952,531
Water closet spring attachment, J. W. Spalding 952,956
Water gage, J. Torok 952,909
Water glass, automatic shut off, C. F. Moore 952,833
Water heater, H. S. Humphrey 952,618
Water heater, C. C. Burgener 952,574
Water motor, C. A. Whelan 952,969
Water purifying, Roche & Oliver 952,842
Water wheel, B. W. Masterson 952,919
Weeder, C. F. Billau 952,697
Weighing apparatus, automatic, A. Bonander 952,587
Well sinking apparatus, J. T. Rea 952,636
Wheelwright machine, A. A. Merrill 952,623
Wick blue flame burner, A. J. Blackford 952,870
Winding machine, I. H. Ballou 952,497
Windmill drive, R. B. Cummins 952,079
Window, P. J. A. Smith 952,690
Wire coiling apparatus, C. L. Ritter 952,592
Wood creosoting, P. F. Dundon 952,888
Wood preserving apparatus, P. F. Dundon 952,887
Woodworking machine attachment, A. C. Tippett 952,964
Wrench, M. A. Shoop 952,955
Yarn or thread, producing, L. E. Palmer 952,757

A printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863 will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

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Inquiry No. 8987. Wanted the manufacturers of the Van Winkle, Woods & Sons and the Weber power motors.

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Inquiry No. 9011.—For manufacturers of machinery supplies, etc., to equip a small plant for the manufacture of iridium tipped gold nib making for fountain pens.

INVENTOR of self-filling fountain pen desires selling U. S. and Canadian patent, without sack, fills barrel, simple construction, move rod to fill. Vogelmann, 78 Cooper Street, Brooklyn, N. Y.

Inquiry No. 9016. Wanted machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

FOR SALE. Double carnation support. U. S. Patents Nos. 960,471-918,672, is the very best on the market; can be manufactured at low cost; large field for it. Will sell account of other business, with complete machines. Very reasonable. Address O. A. Muller, Ambler, Pa.

Inquiry No. 9017. Wanted to buy silk machines from re-reeling, twisting, doubling to the final process of making it into clothes.

FOR SALE.—A practical invention covered by U. S. and Dominion of Canada patents No. 915,462. Address John McLean, Box 126, Green Bay, Wisconsin.

Inquiry No. 9029. Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

FOR SALE OUTRIGHT.—Ladies' Sanitary Belt. Retails twenty five cents. Vast profit. Article marketed. Splendid mail order medium. Have made for time. Patent eleven years to run. Strictest investigation. Arthur Lund, 173 W. 80th St., New York City.

Inquiry No. 9038.—Wanted the address of the Chipman Electric Purifying Co.

PATENT FOR SALE on royalty. Electric Safety Razor. It operates perfectly and eliminates all the objectionable features in the ordinary safety razor. Small and easily handled, without motor. Can be sold for $5.00 with a good profit. Address: A. K. Ryerson, 1904 Lincoln Street, Evanston, Ill.

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WANTED—Organizers Fraternal Social Order of Owls, not insurance. Good commissions. John Talbot, South Bend, Ind.

Inquiry No. 9052.—Wanted, address of firms who install plants to manufacture nitrogen.

WANTED young man, technical graduate in physics and chemistry; knowledge of optics also desirable. Splendid opening and opportunity for right man. Address M. M. Co., Box 773, N. Y.

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REAL REMINGTON $18.75.—One machine only in new localities to secure desirable agent. Special agents prices supplied on all makes of typewriters. 3 ribbons $1.00. Standard Typewriter Exchange, 23 Park Row, New York.

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THE FUTURE FLYING MACHINE.—This machine is balanced automatically in the air, controlled by one steering wheel and carries 1 or 3 passengers. Is practical. Would like to form a company to manufacture them. If interested, address Ralph Cole, Norwalk, Ohio.

Inquiry No. 9071. Wanted, the address of parties making moulds for large concrete vases for flower pots.

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Inquiry No. 9074.—Wanted, to buy old model locomotives or steamboats, such as were exhibited with nickel-in-the-slot attachments in ferry-houses, etc.

Inquiry No. 9075.—Wanted, to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

Inquiry No. 9076.—Wanted, the address of parties in Canada who could make a safety razor.

Inquiry No. 9077.—Wanted, the address of manufacturers that make small articles of wood, such as checker boards, etc.

Inquiry No. 9078.—Wanted, the address of manufacturers of sewer pipe, made of fiber and asphaltum, suitable for laboratory use.

Inquiry No. 9079.—Wanted, parties to make a special steel plate rolled for "angle bars," in large quantities.

Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

Inquiry No. 9081.—Wanted, manufacturers of a mixing machine, to mix powdered and fluid ingredients to a thin dough; also molds to put such dough in to dry; the size to be about 3½ inches long, 2½ inches wide and 1½ inches high, making the form of a cake like sapolio.

Inquiry No. 9083.—Wanted, the address of firms manufacturing small beer brewing plants, from 75 to 100 gallons a day.

Inquiry No. 9084.—Wanted, the address of manufacturers of Irwin portable bath tubs.

Inquiry No. 9085.—Wanted to buy longitudinal hollow perforated tubing.

Inquiry No. 9086.—Wanted, to buy a pine wood peeler.

Inquiry No. 9087.—Wanted, a machine for hardening back saw blades; also a machine for setting same when they have been toothed.

Inquiry No. 9088.—Wanted, the address of manufacturers of family sized peanut pulverizers for making peanut butter.

Inquiry No. 9089.—Wanted, the address of manufacturers of galvanized steel perforated hollow tubing.

Inquiry No. 9090.—Wanted manufacturers of suspender and supporters supplies, also patent adjustable bachelor buttons.

Inquiry No. 9091.—Wanted, parties to manufacture a new patented clothes hanger.

Inquiry No. 9092.—Wanted the address of some firm who manufacture permanent lamp wicks.

Inquiry No. 9094.—Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9095.—Wanted, name and address of the manufacturer of the duplex revolving pencil sharpener.

Inquiry No. 9096.—Wanted the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted, address of makers of impulse water wheels.

Inquiry No. 9098.—Wanted name and address of the manufacturers of the oscullar.

Inquiry No. 9099.—Wanted, address of manufacturers of machinery for making wire cables.

Inquiry No. 9101.—Wanted, addresses of manufacturers of a dip or magnetic needle, for exploring for iron ore.

Inquiry No. 9102.—Wanted, addresses of parties who will manufacture wafer safety razor blades.

Inquiry No. 9103.—Wanted addresses of concerns manufacturing composition materials to take place of hard rubber.

Inquiry No. 9104.—Wanted, addresses of manufacturers under the name of A. O. Co. Standard.

Inquiry No. 9105.—Wanted, manufacturers of cheap gums and resins.

Inquiry No. 9106.—Wanted, addresses of cotton dealers who can furnish cotton material for manufacturing envelopes.

Inquiry No. 9107.—Wanted addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9108.—Wanted the addresses of manufacturers of cardboard.

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9110.—Wanted to buy machinery for reducing old tin cans, so that they may become a source of revenue.

Inquiry No. 9111.—Wanted to correspond with manufacturers who furnish nut-cracks, or similar articles.

Inquiry No. 9112. Wanted sample small dry vacuum pump about 6-inch diameter cylinder inside, high temperature metal packing.

Inquiry No. 9113.—Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114. Wanted name and address of manufacturer of the Auto Lantern Globe. Fits all lanterns.

Inquiry No. 9115.—Wanted a machine for making pen nibs similar to Wm. Mitchell's G. & J. nibs and Waverly nibs.

Inquiry No. 9116.—Wanted machines to make wire netting 6 inches wide by 50 yards long and for galvanizing the wire netting as it is finished.

Inquiry No. 9117.—Wanted names and addresses of the manufacturers of pedometers.

Inquiry No. 9118.—Wanted, a muffler for a gasoline engine, built upon the principle of the Maxim silencer, recently brought out for use on rifles.

Inquiry No. 9119.—Wanted, name and address of the manufacturer of Berlin bullet-proof cloth.

Inquiry No. 9120.—Wanted, the address of the Ideal Fowl Feeder Co.

Inquiry No. 9121.—Wanted manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9122.—Wanted, manufacturers of ditching machines used for tiledrains operated by horse power.

Inquiry No. 9123. Wanted, names of importers or dealers in crude gutta percha and rubber.

Inquiry No. 9124.—Wanted, name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9125.—Wanted name and address of the Just-Hatmaker machine, for manufacturing milk powder.

Inquiry No. 9126.—Wanted, to buy machine for putting up and preparing condensed milk.

Inquiry No. 9127.—Wanted, address of L. Dumigny, manufacturer of a family ice machine for $10.00.

Inquiry No. 9128.—Wanted, a hand planer, for metal working, in which the hand planer is made to be attached to any ordinary bench vise. The vise and the planer are combined to form only one machine.

Inquiry No. 9129.—Wanted, addresses of makers of machinery for paper box factories, of new or second-hand paper box making machinery.

Inquiry No. 9130.—Wanted, parties to manufacture a new patented shell for shot guns.

Inquiry No. 9131.—Wanted, information as to how or where I could get a sample of tin ore.

(Concluded from page 289.)

...sequence of the continuous movement of the walls, the flame cannot be brought to bear against any one point in the armor plate long enough to melt it through.

The Action of Radium Emanation Upon the Elements of the Carbon Group.

A lively sensation was created, two years ago, by the publication of Sir William Ramsay's experiments on the action of radium emanation upon copper. According to Ramsay, the energy released by the emanation causes a disintegration of the atom of copper, and converts that metal into elements of smaller atomic weight, which are included in the copper group, in Mendeléeff's classification. Ramsay claimed to have found, among the products of the action of the emanation upon copper, minute quantities of potassium, sodium and lithium. Madame Curie repeated Ramsay's experiments, but failed to obtain the same results, and pointed out certain possible causes of error in the method employed by the English physicist. Ramsay has since repeated the experiments, taking care to eliminate these possible sources of error, and has reached the same results and conclusions as before. He has lately extended his researches to certain elements of the carbon group (silicon, titanium, zirconium, thallium and lead), which, if his hypothesis is correct, should be disaggregated by the action of the emanation into simpler elements of the same group, and especially into carbon.

The following method was employed by Ramsay and his collaborator Usher. From a solution of radium bromide containing 211 milligrams (about 3 grains) of the metal radium the emanation produced in the course of one week, together with the explosive mixture of hydrogen and oxygen which always accompanies it, was extracted by a pump. The total quantity of gas thus obtained amounted to about 25 cubic centimeters, and contained 0.0912 cubic centimeter of radium emanation, mixed with hydrogen, oxygen, carbon dioxide and other gases. The hydrogen and oxygen were combined by explosion, reducing the volume of the gaseous mixture to ½ cubic centimeter. This was collected in a small glass tube coated with fused caustic potash, which absorbed the carbon dioxide in the course of an hour. The residual gas was then introduced into a glass flask containing the solution which was to be subjected to the action of the emanation. The contents of the flask were left undisturbed for four weeks, at the end of which period the activity of radium emanation is completely exhausted. The gas was then drawn off and analyzed.

It was found to contain carbon dioxide invariably and carbon monoxide in some cases. The following table shows the quantities of carbon thus produced from various solutions by one cubic millimeter of radium emanation.

Solution of		Milligrammes of carbon
Hydrogen silicon fluoride	H_2SiF_6	0.518
Titanium sulphate	$Ti(SO_4)_2$	0.982
Zirconium nitrate	$Zr(NO_3)_4$	
		1.071
		0.873
Thallaium nitrate	$Th(NO_3)_4$	
		2.930
		0.968
Lead chlorate	$Pb(ClO_3)_2$	0.102

Ramsay and Usher conclude that carbon is produced, in greater or smaller quantity, from all the other elements of the carbon group by the action of radium emanation. The elements of high atomic weight, with the exception of lead, which seems to be particularly stable, appear to be disaggregated more easily than the elements of low atomic weight. Experiments on elements of other groups are in progress, but those described above appear to prove beyond question that the atoms of the chemist can be broken up by the action of radium emanation.—Revue des Sciences.

SCIENTIFIC AMERICAN

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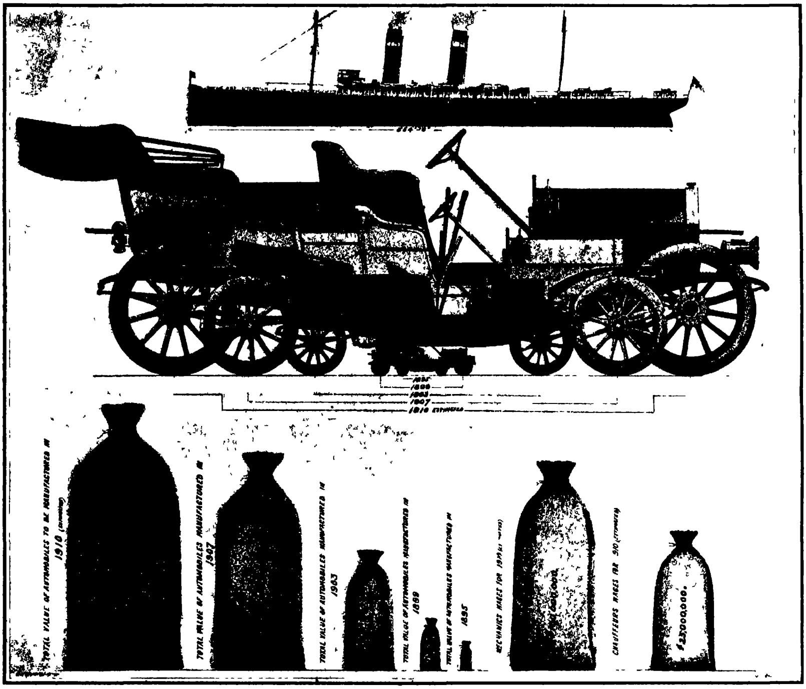
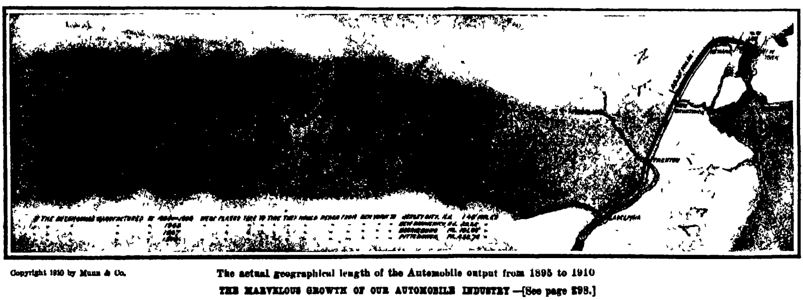


In the upper picture the Automobiles of 1895 to 1910 are compared with the "St. Paul." In the lower picture we show what the Automobile Industry means in dollars.



The actual geographical length of the Automobile output from 1895 to 1910

THE MARVELOUS GROWTH OF OUR AUTOMOBILE INDUSTRY.—[See page 298.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, APRIL 9th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LIEUT. SHACKLETON.

However thrilling the average man may find Lieut. Shackleton's modest and self-effacing recital of the Antarctic hardships and triumphs of his brilliant expedition, it is to the scientist that the English explorer's character must assuredly appeal most strongly. No doubt the dare-devil courage of the Englishman, whose love of adventure has carried him into the heart of Africa, the wilds of Australia, and the mysteries of Thibet, enters largely into Shackleton's nature. How else could he have endured the numbing cold and the pangs of privation? But the sacrifices made during that famous expedition which brought him within actual sight of the South Pole are essentially scientific in character—comparable with the heroism of the man who exposes himself to the stings of disease-carrying insects, that mankind may know how best to protect itself against the ravages of yellow fever and the sleeping sickness. His modesty of demeanor and speech, his generous praise of those who accompanied him, his liberality in donating mineralogical and ornithological collections to our museums (collections made when the desire was strong to abandon them in the hour of weakness and hunger), and above all that unwillingness of his to appear as rival to Capt. Scott, his former chief, which has led him to postpone his own Antarctic plans so that Scott may have no difficulty in obtaining funds, are all characteristic of the unselfish scientist in whom the sense of personal importance is overwhelmed by the high ideals of the cause in whose furtherance he is engaged.

Scientific too in its purpose is the expedition that Shackleton has postponed in deference to Scott, for that expedition will be undertaken not primarily to reach the Pole, but to fathom the many mysteries of the unknown land fronting on the South Indian Ocean, and presenting many scientific and geographic problems for solution. By systematically exploring the coast around King William Land, a coast which has never been carefully studied from shipboard because of floating ice, he will probably determine once and for all whether there is any reason for questioning the claims made by Admiral Wilkes to the first discovery of the Antarctic Continent. Shackleton's sense of fair play, his sense of scientific justice, in other words, eminently fits him for this peculiarly delicate task.

The hearty recognition which Shackleton has accorded Peary for the discovery of the North Pole, coming as it does from a man who knows something of the rigors of polar exploration, ought to shame the Congress which refused national honor to Peary without proof of the North Pole's discovery. The doubt which has been foolishly cast on Peary's exploit by a congressman whose "farthest north" as one Washington correspondent phrased it, is the semi-tropical cold of Omaha, Neb., is more than extinguished by the cordial deference which Shackleton has shown toward Peary on the occasion of their many public meetings.

A PLEA FOR CO-OPERATION.

The development of rapid transit in New York city has reached a critical stage, for upon the events of the next few months will depend the question whether a certain proportion of future subway travel is to be paid for at the present rate of five cents per trip or at double that amount.

Now, it is generally agreed that one of the indispensable conditions of the future development of the subway system in this city is that the fare shall at no time exceed five cents, for which sum a passenger must be at liberty to travel from any one part of the system to any other. The universal tendency to-day is toward the cheapening of transportation, and the possibility of an increase from five cents to ten cents per trip is not to be considered for a moment.

Nevertheless, the people of this city are to-day confronted with the possibility, if not the probability, of just such an increase of fare, and this condition is due in large measure to the strained relations between the Public Service Commission, whose duty it is to safeguard the transportation interests of the public, and the Interborough Company, which has a practical monopoly of local transportation. The Public Service Commission will shortly call for bids for the construction of an additional subway extending from the Bronx to the Battery, which will be absolutely independent of the route which is now in operation. The new line as laid out would be an excellent one, were it not for the grave defect that nowhere does it make connection with the existing subway. This defect, however, must be made good by providing for such connections as will enable a passenger to travel for one fare from any point on the one to any point on the other system.

If we look at a map of the present subway route, it is evident at a glance that an extension of the existing lines north from Forty-second Street through Lexington Avenue to the Bronx, and an extension of the Broadway line from Times Square down Seventh Avenue to the Battery, would provide the city with two independent north and south routes. The Public Service Commission long ago recognized that this was the next logical addition to make to the present facilities, and they hoped that the Interborough Company would make a proposal for future extensions of their system over these routes. Unfortunately, the company, in offering to build these lines, has obstinately saddled its proposal with a demand that it be allowed to build a third track on one of the elevated railways of the East Side.

Now, the city, as the Interborough Company very well knows, has established for all time the principle that, since the existing elevated structures are a defacement of the streets in which they stand, not only shall no further extensions be made, but as soon as other facilities are provided, the existing structures shall be removed. Therefore, the Public Service Commission at once and very properly refused to accede to the Interborough proposal, and, ostensibly, it is upon this question of extending the elevated service that the Commission and the company are at variance.

Failing to get any satisfactory proposal from the Interborough Company, the Commission have laid out an independent route, which extends from Woodlawn and Pelham Bay Park in the Bronx to the Harlem River, and down Lexington Avenue and Broadway to the Battery. Bids will shortly be asked, and as we have noted above, unless the Interborough should put in a bid agreeable to the conditions laid down by the Commission, the new line will be built independently of the existing subway. Thereafter, if anyone should have occasion to make a trip involving a transfer from one system to the other, he will be able to do so only by the payment of an additional fare—a condition which for a large proportion of the traveling public would amount to a positive hardship.

Now the contingency of having to pay a double fare is so serious that it demands immediate and careful consideration. We believe that the exercise of a more liberal policy by the Interborough Company and the exhibition by the Public Service Commission of a little more confidence in the attitude and purposes of the Interborough people would result in a compromise of lasting benefit both to the corporation and the traveling public. The Interborough Company certainly owes much to the city, and we say this with full remembrance of the fact that Mr. Belmont, at a time when capital was looking askance upon the subway proposition, came forward courageously and provided the enormous capital necessary for construction. He has received in the past and always will receive credit for the good service which he rendered to the city in a very critical emergency. But having admitted this much, we cannot lose sight of the fact that events have proved, first, that the subway property is enormously profitable, and second, that the terms governing the relationship between the operating company and the city are very liberal indeed. If Mr. Belmont conferred a great benefit upon the city, the city has repaid him tenfold by providing the subway line with a traffic far greater than was anticipated when the road was built.

Now the Interborough, with its magnificently equipped system, its thoroughly trained personnel, its strong financial standing, and its rich accumulation of operating experience, is obviously the interest best equipped to build and operate the new line, making it an integral part of its present system. Provided it will give reasonable guarantees, the city would just as soon, and perhaps rather, have the Interborough people build and operate the new system than any other outside interest. Unfortunately, the attitude of the company toward the city in the past, as shown in its almost contemptuous treatment of the Public Service Commission, has had the inevitable effect of producing a feeling of distrust, if not of hostility, against the company on the part of the public. This [illegible] tunate, unnecessary, and, to those of us wh[illegible] stand what a really magnificent service, fu[illegible] least from the technical side, the company is [illegible]ing, it is to a certain extent unjust.

The present juncture affords a great opport[illegible] to the Interborough Company. If it will only waive its never-to-be-granted demand for further elevated railway facilities, the city will meet the company in a liberal spirit. Should the company put in a bid for the new line, with a pledge to operate it as part of their existing system upon a single-fare basis, they will solve at once the problem of the present congestion on their own lines, they will more than double the extent of their already enormously profitable field of operations, and they will place themselves once more on a basis of amicable relationship with the people of this great city—a consideration, surely, which will not be the least weighty of those above enumerated.

A REFORM IN METEOROLOGICAL UNITS.

In common with the other sciences, meteorology is burdened with a dual system of units. Great Britain and America continue, in a majority of their meteorological publications, to record rainfall and atmospheric pressure in inches, wind velocity in miles per hour, and temperature in Fahrenheit degrees, while all the other nations have long since adopted millimeters, meters per second, and Centigrade degrees for the same respective measurements. There have of course been many projects of reform, but only very lately has uniformity actually been attained in any branch of the science.

The United States Weather Bureau and the British Meteorological Office have definitely adopted the metric system and the degrees of the Centigrade temperature scale for recording the results of the observations made with kites and balloons—the former at its research observatory at Mount Weather, Va., and the latter at several "aerological" stations now in operation in the British Isles.

The British have gone a step further. The temperatures met with in the upper air are very frequently below the freezing point, so that the tabulated observations expressed in the Centigrade scale, abound in negative values, which are awkward to deal with and also a fruitful source of errors in computation. The *absolute scale*, counting in Centigrade degrees from the absolute zero (−273 deg. C.) has no negative values, and the use of this scale is now common in the discussion of many physical problems with which upper-air research is closely concerned. For these reasons the Meteorological Office has begun using the absolute scale (also called the Kelvin scale) instead of the ordinary Centigrade scale in all records of temperature obtained by means of kites and balloons. A no less radical reform has been introduced in the publication of barometric pressure, in the same class of British observations. The unit adopted is a C. G. S. unit of force, viz., the megadyne per square centimeter, in place of the familiar units—inches or millimeters—expressing the height of the mercurial column. As a matter of fact, the "mercurial column" is a pure fiction, so far as the observations in the upper air are concerned, the barometers attached to the kites and balloons always being aneroids, and it is much less important to know the height of this imaginary column at any level than to know the fraction of the atmosphere that lies above or below the level. This fraction is directly indicated when the C. G. S. unit is employed, since 1 megadyne per square centimeter is practically equivalent to a barometer reading of 750 millimeters, in latitude 45 deg., which is the average pressure of the air at 106 meters above sea level in the same latitude. Hence, if we assume 106 meters above sea level as the plane of reference in barometry (and there are sound reasons for preferring it to sea level, the plane heretofore in use), the C. G. S. unit may be considered a "C. G. S. atmosphere," and the fraction of a megadyne per square centimeter recorded at any latitude gives, for all practical purposes, the fraction of the atmosphere that lies above the point of observation. This unit has been named the *bar*, and its use in all meteorological observations has been recommended by several writers during the past year.

Lastly, the Meteorological Office is now, in its kite and balloon work, recording the direction of the wind in degrees of a circle, counting from true north. East is 90 deg., south 180 deg., west 270 deg., and north 360 deg.

It is proposed to establish a wireless telegraph station at the meteorological observatory on Mount Mirador in the Philippines, to give warning of typhoons to vessels in the China Sea and points along the China coast. A similar station will probably be established later at Santo Domingo de Basco on the Island of Batan, for communicating information of the presence of typhoons in that vicinity to the headquarters of the Philippine Weather Bureau at Manila.

ENGINEERING.

The grand total of canal excavation at Panama during February was 2,662,995 cubic yards, of which 1,779,[illegible] cubic yards was dry excavation, done principally by steam shovels. The amount taken out by the French during their occupancy of the canal was about 78,000,000 cubic yards. Under American occupation, from May 4th, 1904, to February 28th, 1910, over 100,000,000 cubic yards have been removed, leaving 74,497,000 cubic yards of excavation to complete the canal.

It is inevitable that the New York Central Railroad's huge excavation for its new station yard will be ultimately covered with buildings. An earnest of this is found in the fact that contracts have been signed for the construction of two large buildings, each of which will cover an entire city block, the new structures to face on Lexington Avenue, and to be supported on the heavy steel columns of the depressed station. The buildings, which will be known as the Merchants' and Manufacturers' Exchange, will contain 1,200,000 square feet of floor space.

The contribution of Australia and New Zealand to the British Imperial Navy will consist, in each case, of a cruiser-battleship of the same type, but larger than, the "Inflexible," which was present at New York during the Hudson-Fulton Celebration, together with three 5-000-ton, 26-knot scout-cruisers, six torpedo-boat destroyers and several submarines. Each cruiser-battleship will cost about $9,000,000, and each fleet unit about $20,000,000. They will form an integral part of the British Navy, and will be subject to the regular naval orders.

The Committee on Electrification of the New York Railroad Club, after a year's study of the subject, reports that no general information is available on the basis of which steam railroads as a whole would be justified in electrifying terminals or main lines solely on the ground of economy. They consider that more attention should be given to the possibility of electrification in connection with heavy grades, and that it is necessary to proceed with caution in attempting the electrification of large freight terminals, which necessarily involve the traffic of a number of different roads.

The Committee on Wood Preservation, in a report delivered at the annual meeting of the American Railway Engineering and Maintenance-of-Way Association, states that the average results of tests of Douglas fir indicate a decrease of the modulus of elasticity of from 10 to 15 per cent for creosoted timber, as compared with untreated timber, and a decrease of about 30 per cent in the outer stress at elastic limit and at failure. Creosoting appears to have little effect on Douglas fir in tension or end compression, but it does weaken it from 20 to 25 per cent in shear. Tests with other timbers show, as a rule, corresponding decreases in strength as the result of creosoting.

In protesting against the granting of any further vault rights under sidewalks to owners of buildings along the principal streets of the city, the Public Service Commission has drawn attention to a most important subject. Such encroachments interfere greatly with the laying out of new subways, particularly beneath the narrower thoroughfares which are found in the lower portions of the city. The commission states that in Manhattan the practice of spreading foundations beyond the building line has already gone so far that much needed space in the streets has been taken, and that if the city enforced its legal rights, the foundations of some of the large buildings would be affected.

It is gratifying to learn that the latest battleships of the United States Navy are not only living up to their contract speeds, but in recent 4-hour trials under full power at forced draught have even exceeded the original contract performance. The latest instance of this is the case of the "Louisiana," which, according to a dispatch to the Navy Department from Rear Admiral Schroeder, recently on a 4-hour full power trial maintained an average speed of 18.942 knots, and this in spite of the fact that she drew about 16 inches more water with about 1,000 tons greater displacement than on her contract run. The "Michigan" also made 19.42 knots, which is about a knot above her contract speed.

The recent frightful accident near Green Mountain, Iowa, in which forty-seven lives were lost through the telescoping of two wooden railway cars, again draws attention to the danger that lurks in wooden construction when the cars are subject to the crushing and telescoping effect of a collision. The heavy train of thirteen coaches was drawn by two locomotives which were running tender first. The foremost tender jumped the track in a railway cut, and the engine, swinging around, became tightly wedged, causing the huge momentum of the train behind to be expended in telescoping into each other the day coach and smoker in which the fatalities occurred. Had the cars been of steel the fatalities would probably not have been one-fourth as many.

ELECTRICAL.

An electric elevator has been installed in the stairway which leads to the cupola of St. Peter's Church in Rome. The elevator has a capacity for carrying ten persons. It bears an appropriate Latin inscription.

A new combined electric and steam cooking range has recently been patented which is particularly adapted for use in hotels. The range is divided into two compartments one of which is heated by steam, while the other is electrically heated. The latter is used for cooking, while the steam is used for heating the ovens. It is claimed that in this way a steady supply of heat is obtained very economically.

The Brooklyn Rapid Transit Company recently changed the form of brake used on its cars, adopting a "graduated release, quick-recharge" type. In order to teach the motormen the best way of using the new brakes, an air-brake catechism has been issued, and lectures have been given on the subject. In the mean time a text-book is being prepared showing in detail how the brakes are arranged and how they should be used.

The Berlin police department is provided with an extensive typewriting telegraph system. There are about 200 receiving stations throughout the city and suburbs. The sending instrument is provided with a keyboard, and when the keys are depressed they cause the message to be printed simultaneously at the sending station and at the receiving station. The object of this system is to do away with the confusion of the Morse code. If the Morse code were used, it would have to be transcribed before a message could be put in the hands of the officer to whom it was sent.

A series of experiments was recently made at Johns Hopkins University to determine the dielectric strength of air. It was found that the point at which a brush discharge occurred is only slightly affected by the moisture in the air. From dry air to saturated air there is a drop in voltage of the discharge of less than 2 per cent. An increase of temperature from the freezing point to 40 deg. Cent. caused the lowering of voltage by about 3 per cent. Very curiously it was found that the size of the conductor materially affected the ionization of the air.

An investigation into the conductivity of electric insulators was recently discussed in the Physikalische Zeitschrift. It was found that hard rubber is greatly affected by light, particularly ultra-violet rays, and that gutta percha is similarly affected though not to the same degree. Chemical action appears to take place on the surface of the insulator, which produces a conductive coating. Sealing wax and paraffine are also affected to a degree by light, but they are more subject to breakdown because of moisture. The conductivity of wood is to a far greater degree increased by moisture. Glass makes a very erratic insulator the same rod of glass may have parts that differ materially in conductivity. The investigation also brought out the fact that the insulating qualities of all insulators decrease with an increase in temperature.

About a month ago one of the Edison storage battery cars was placed on the Twenty-eighth Street crosstown line as an experiment. The car has been in constant operation since and has required no alterations or repairs other than are common to the ordinary street car. It has proved remarkably economical in the consumption of power. Instead of costing two cents a mile as was at first stated, the actual cost of the car has been less than half a cent—0.43 cent to be exact. It costs more to start and stop the car than to keep it running, and it was supposed by practical street railroad men that when the car was put into active service on congested streets, the cost of running it would far exceed the estimate made by the builders. So satisfactory have the experiments with this car proved, that an order has been placed with the Edison Company for sixteen more to be used on the Twenty-eighth Street crosstown line.

A decidedly novel wireless telegraph detector has recently been invented by Prof. Rossi of Turin. It depends upon the torsional vibration of a fine iron wire, which is acted upon by magnetic lines of force that have a spiral direction. The wire is stretched close to two permanent magnets with like poles adjacent, and is also placed in the center of a coil through which current is passed that sets up a helical flux. When the current through the coil is rapidly alternated the wire vibrates circularly, that is, it has a reciprocal rotary motion. At the center of the wire is a mirror which reflects a beam of light on a screen. The vibration causes the light to spread out into a line whose length depends upon the amplitude of the vibration. When connected with an antenna, the oscillatory currents set up therein cause variations of the vibratory movement of the wire. The wire has a natural period of torsional vibrations, and this being known it is possible to attune the instruments at the transmitting station to produce a maximum effect on the screen.

SCIENCE.

Mr. Henry Wilde, F.R.S. of Alderley Edge, is providing Oxford University with funds for the institution of an annual lecture as a memorial of Halley.

A monument to Horace Wells was unveiled on March 7th in the Place des Etats Unis Paris. Wells was born in Hartford Conn., in 1815 and was a pioneer in the use of nitrous oxide gas in dental operations. He committed suicide in New York in 1848.

We have read somewhere that Peter the Great, when he was staying in England, had a particular liking for the companionship of Halley, and that after carousing with him at Deptford one evening he wheeled him in a barrow through a yew hedge and did such damage that he had to pay handsome compensation to John Evelyn the owner which incident shows that Shakespeare was right in thinking that not every astronomer plucks his judgments from the stars.

Gold is usually classed among the metals which are soluble only in aqua regia, i. e. a mixture of nitric and hydrochloric acids. It has been observed however, that hydrochloric acid alone is able to dissolve gold, in the presence of certain organic compounds, which are here arranged in order of activity. Methyl alcohol, amyl alcohol chloroform ethyl alcohol, chloral hydrate, phenol (carbolic acid) cane sugar glycerine trioxymethylene, formaldehyde. The solution takes place slowly in the cold, but is accelerated by heating.

The Meteorological Office at London and the Deutsche Seewarte at Hamburg carried on jointly in February March, and April of last year and again in August and September, an elaborate investigation with regard to the use of wireless weather reports from vessels in weather forecasting. The co-operation of the principal British and German transatlantic steamship lines was secured, and each of their steamers sent reports twice daily while they were within a prescribed zone of the ocean. The net result of these experiments was that a majority of the reports arrived too late to be of any service to the forecaster. It appears unlikely that the meteorological institutes will feel encouraged to take any further steps in this direction until the delay in transmitting messages from ships to shore stations is much reduced. The Seewarte has announced that of the messages received promptly enough to be utilized by the forecaster during August and September, none led to any modification of the forecast as based on reports from land stations, but it is admitted that this might not have been the case with a different disposition of the weather conditions over the ocean.

The Austrian State sale of radium has been entrusted to the "Bergwerks-produktenverschleiss Direktion" in Vienna, under the control of the Austrian Minister for Public Works. The radium is sold in the form of radium barium chloride of three different grades the price for each milligramme of radium chloride, including the containing cell, being 400 kronen. It is packed in cylindrical cells of 21 millimeters diameter and 9 millimeters long, formed of nickel plated brass. On the bottom of the cell a layer of lead is cast, in which is a square depression for the reception of the radium barium chloride. The cell is closed by a mica plate held in position by the screwed on upper part of the casing. On the bottom of the casing is an official stamp (an eagle) and the series number. Radium cells sealed with lead and stamped on the soldered part, are also supplied. The cells are packed in cotton and sheet lead in a small box, together with a certificate bearing the number of the cell and the weight and radium-content of the preparation. The boxes are sealed with strips bearing the numbers of the cells, and are despatched by post as registered packets at the cost and risk of the purchaser.

Upward of twenty different systems of storm signals are at present used by the maritime countries of the world. A uniform international code is a desideratum, and the task of devising one was intrusted by the International Meteorological Committee to a small commission which met in London last summer and agreed to recommend to the committee the adoption of a code proposed by Prof. Moore chief of the United States Weather Bureau. This code substitutes a few simple combinations of the large conical symbols now used at a majority of the European ports for the storm flags heretofore used in the United States and some other countries. Combinations of red and white lanterns are to be used at night to convey the same information as the day signals. The proposed code has not yet however been formally adopted by any government, pending the decision of the International Meteorological Committee which meets in Berlin next September. Since the London meeting objections have been raised by the German authorities to the proposed night signals on the ground that they are not sufficiently distinctive and might be confused with other harbor lights. The Deutsche Seewarte at Hamburg is now experimenting with several systems of night signals and will lay the results of its investigations before the committee.

TIMING AN AUTOMOBILE RACE

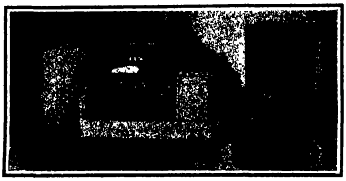
AN AUTOMATIC INSTRUMENT THAT TAKES THE PLACE OF A STOP-WATCH

Even the casual reader has no doubt observed that automobile records are now expressed in hundredths of a second, whereas but a few months ago it was impossible to obtain any greater precision than fifths of a second, all of which indicates that the use of the time-honored split-second stop-watch has been outgrown in automobile races When one stops to think about it it is really absurd to try to time an automobile travel ing anywhere from a mile to two miles and over per minute with an indicator that crawls at a snail's pace around a dial but an inch and a quarter in diameter In the recent race at Ormond, for instance where the mile record was reduced to 27 33 seconds by Barney Oldfield he was traveling nearly 200 feet each second, which is equivalent to the length of an ordinary New York city block When automobiles were first used for racing purposes, they were timed by hand with stop-watches But, wherever an operator is depended upon to snap a stop-watch, inaccuracies are apt to creep in due to the fact that one person is quicker of perception than another The timer must see the start of the race, and as soon as this impression is received must start his watch, then at the close of the race the same operation must be undergone to stop the watch The time required for this mental and physical operation varies in different persons, and is known as the personal element Not only does it vary with different persons but with the same person at different times depending upon his mental and physical condition For this reason, even in the timing of foot races it was long ago found necessary to have three timers and to take the time of the middle watch, for the instruments of the three timers varied as much as three-fifths of a second

Early in the history of automobile racing an effort was made to eliminate the personal element by having stop-watches snapped automatically by the cars themselves making or breaking an electrical contact when they crossed the starting and finishing tapes But, as we have just pointed out, even with the personal element eliminated, stop-watches are entirely too slow to record the time of so rapidly moving an object as a racing automobile The experiment of using a chronograph was tried in several of the races last year but as this did not prove very satisfactory, Mr C H Warner of the Warner Instrument Company determined to make a special instrument particularly adapted for this purpose This instrument was first used at Atlanta last December, and has just been employed for timing the Ormond and Daytona races It works with the utmost precision, is entirely automatic, and makes a printed record of the race, reading to hundredths of a second The necessity of such great refinement of timing will be appreciated when one considers that the "Lightning Benz" during its record mile run was traveling at the rate of 21 18 inches at every hundredth of a second

Mr Warner's instrument consists of four type wheels, one of which indicates hours the next minutes the third seconds, and the last one-hundredths of a second The wheels are operated after the manner of an odometer instrument. Over the wheels runs a strip of paper and above that a typewriter ribbon, and a record is made by a hammer actuated by an electro-magnet, which strikes the ribbon and paper against the type wheels. In the circuit of the magnet which operates the hammer is a relay switch controlled by an electro-magnet in a circuit that is normally closed This closed circuit is connected with the starting and finish tapes, or with tapes at other points where it is desirable to record the time The tape consists of a wire stretched across the course at a height of a few inches above the ground and this wire is connected, to a switch ingeniously constructed to be opened by the shock, rather than an increase of tension when the wire is struck by the wheels of an automobile When the switch opens the instrument prints a record The type wheels are frictionally mounted on a driving shaft, which is rotated by an electric motor At the start of the race they are held stationary, and are not released until the starting wire is depressed, when they print zero and they begin their revolutions. The hundredths wheel makes a revolution every two seconds.

Obviously, the most important part of the instrument is the regulation of the electric motor which drives the type wheels It is impossible to construct a motor so perfect or a storage battery that will discharge so uniformly, that there will be not the slight

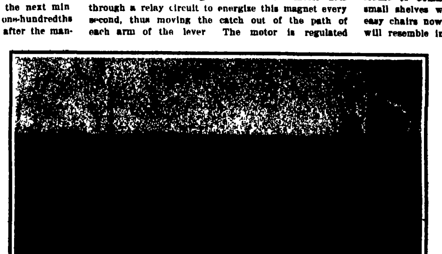


An instrument that times races to hundredths of a second.

est variation in the rotation of the driving shaft. However, the instrument is so arranged that at the end of every second its speed is automatically checked up with an accurate chronometer At one end of the driving shaft is a double-armed lever, and in the path

Switching in the instrument as a car is approaching the tape.

of this arm is a small catch connected with the armature of an electro-magnet. The chronometer acts through a relay circuit to energize this magnet every second, thus moving the catch out of the path of each arm of the lever The motor is regulated



Barney Oldfield approaching the finish line at the end of his record mile run.

TIMING AN AUTOMOBILE RACE.

to turn the shaft ever so slightly faster than one turn in two seconds, so that each arm strikes the catch just an instant before it is withdrawn. Secured to the base of the instrument at one side is a little "telltale" indicator, forming the armature of an electro-magnet The circuit of the magnet is closed whenever the arm and catch contact, thus giving the "telltale" a slight throb every second. The operator of the instrument watches this "telltale," with his hand on the governor of the electric motor, and if the "telltale" indicator lingers too long at each contact of the arm and catch he slows up the motor a trifle, whereas if the "telltale" fails to register a contact he speeds up the motor slightly, so that the arm will strike the catch just before or at the moment that the catch is withdrawn by the chronometer In this way a very accurate check is kept on the timing of the motor, which can be regulated to within 1/1,000 of a second of the speed of the chronometer.

In order to avoid a false start due to a person's walking against or tripping over the tape lines, the timing instrument is cut out of circuit with the starting lines until just before an automobile is about to touch them. An assistant gives a signal to the operator of the instrument at the proper time, and he throws in a switch just in time to catch the record of the automobile. At the same time the assistant calls out the number of the automobile, which the operator enters on the paper strip alongside of the registered time. When the car reaches a distant wire, the fact is communicated to the operator's assistant by telephone. It will be observed that no personal element whatever enters into the recording of the time made by the machines, and that everything is automatic except the regulation of the speed of the motor and the entering of the automobile numbers opposite the records they have made

One of our photographs shows Barney Oldfield in his "Lightning Benz" just as he is approaching the finish line The other photograph shows Mr Warner in the timing stand about to take the record of the approaching car

To Remodel the House of Representatives.

Because the acoustics of the House of Representatives are so bad that it is almost impossible for the Speaker to hear a member of the House, unless that member has lungs of leather, plans have been drawn and all preparations made for a transformation of the lower house of Congress.

For many years now there has been trouble in the House both in the way of acoustics and with ventilation For such a large body, these two principal features have not been as they should be. The plans in contemplation will remedy these defects, and make the House one of the finest legislative chambers in the world

One of the main ideas to be put into execution is the reducing in size of the chamber In this way it is thought that with smaller quarters, doing away with some of the galleries, and by narrowing the chamber, the acoustics will be all that could be desired The ventilation will also be arranged to better advantage.

The plans as contemplated also bring the House of Representatives in the same fashion as the British House of Commons. In this manner benches and small shelves will take the place of the desks and easy chairs now used by the members. The benches will resemble in appearance the chairs used in theaters. By taking away the desks and easy chairs, it is thought that those members not interested in the debates or speeches will absent themselves from the chamber

The floor of the present chamber has an area of nearly 8,000 square feet. The floor plan of the proposed hall will only be about 6,200 square feet. The seating capacity of the new hall will be 420, although there are now less than 400 members of the House.

Some of the lobbies and extra rooms will be cut out, and the reduction in size of the hall will, of course, result in the reduction of the public galleries, whose seating capacity will be reduced about one-third.

Owing to the peculiar conditions of the hall, with regard to the acoustics and ventilation, many members while away their time by conversing with each other in loud tones or add to the confusion by slamming their desks or kicking the cuspidors. Experiments are being made now for a noiseless cuspidor and one which cannot be kicked around.

Congress has already appropriated over half a million dollars for the transformation, and the workmen are waiting for the adjournment to begin operations.

A FINE LONG-SPAN MASONRY ARCH BRIDGE

BY OUR ENGLISH CORRESPONDENT

There has been erected on the new Bellegarde-Chézery electric railway in France a masonry bridge which in span and height ranks as the largest of its type in the country, and which possesses many interesting features. The bridge is situated in the Department de l'Ain, and is in close proximity to the frontier of Switzerland in the canton of Geneva. This imposing structure was designed and erected under the supervision of Monsieur Picard, engineer in chief of the Bridge Department, to whose courtesy we are indebted for the accompanying illustrations and details, and Monsieur Dor, road surveyor in chief of the department.

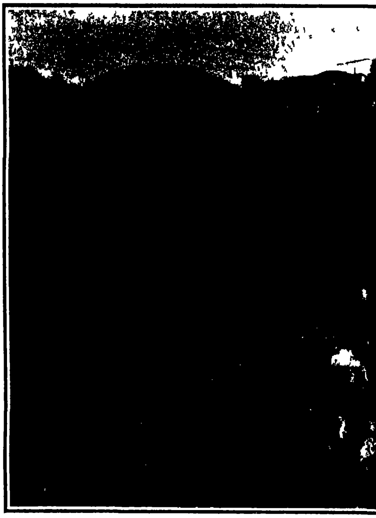
The new railroad passes through the wildest and most picturesque spots of the Jura Mountains and in its location follows the course of the Valserine stream, a tributary to the Rhône. This rivulet is crossed twice, first by means of the Bellegarde viaduct comprising seven spans each of 60 feet in the clear by 150 feet in height, and secondly by a handsome masonry bridge, the Moulin des Pierres, or Montangas, which has a main span of 262 feet 9¼ inches.

At the latter crossing the river flows through a deep rock gorge, the precipitous banks of which are over 170 feet in height. The rock was found to be of such excellent bearing quality that the engineer in chief decided to use the cliffs as the abutments of a large single arch. The latter in springing from the sides has a radius of 164 feet ⅛ inch for the arc at the intrados and of 177½ feet at the extrados. The thickness of the masonry at the key stone is 4 feet 11 inches and at the springing 8 feet 2¼ inches, while the width is 17 feet 10⅛ inches, increased at the coping to 20 feet 8 inches between parapets, which is sufficient to provide width for two foot pavements, a railroad track of meter gage and a roadway paralleling the railroad track.

The eleven small arches which surmount the great span on either side have semicircular openings of 17 feet 4½ inches clear. They are carried on piers having a thickness at the top of 3 feet 5⅝ inches and the sides parallel with the axis of the stream have a batter of 1 in 10 from the point at which they rise from the main arch.

Owing to the depth of the ravine the erection of such a large single span bridge called for some extensive framework. As the keystone of the main span is approximately 217 feet above the level of the water it was necessary to erect wooden falsework from the stream to the level of the abutments to carry the centering, and this temporary work comprises three substantial towers built of wood and strongly braced together. The towers were each some 111 feet in height and were erected on masonry piers 11 feet in height built on piles driven in the bed of the stream.

In erecting the towers it was imperative that ample provision should be made for wind pressure, as



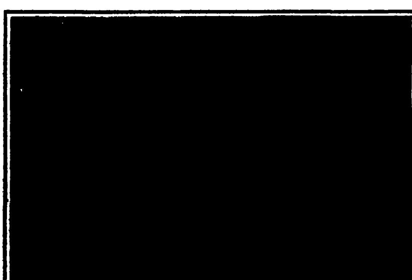
Timber falsework ready for the laying of the masonry.

the storms which drive through this ravine are often of extreme severity. This was accomplished by tying the towers to each other and to the embankment rock and the pier bases by steel cables so arranged as to provide a system of bracing which served to hold the whole of the falsework perfectly rigid. The intricate character of the timber centering is plainly visible in the accompanying illustrations and it may be mentioned that in this part of the work 21,188 cubic feet of wood and 10 tons of iron and steel were used.

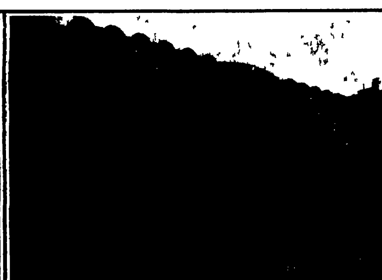
In placing the masonry in position care had to be observed to guard against any sinking of the timbering under the superimposed weight, and in order to lessen the extent of any deformation from this cause the engineers caused the stonework to be laid in eight sections independent of one another, which were finally connected together. An aerial cableway was erected across the gorge, by means of which the timber piers, centering and arch were erected, the whole of the material being conveyed to its site and set in position by this means.

The bridge was commenced in August, 1908. By January 17th of the following year the whole of the timber falsework had been set up and the erection of the masonry was completed by August 31st last. When the masonry work was finished the timbering was dismantled. The removal of the centering was accomplished by emptying the boxes filled with sand on which the various parts of the falsework frame rested, which dropped the whole of the timbering sufficiently to enable it to be handled. The falsework was demolished without any movement being noticed in the masonry by November 7th last. When completed the bridge will excel in span any similar work existing in France, while its height over the valley, which is equal to that of the towers of Notre Dame in Paris, is greater than that of any other [illegible] single span masonry bridge elsewhere in the world. Its total cost will approximate $72,000.

According to the Electric Railway Journal experiments with a method of increasing traction by magnetic wheels have been conducted for some time by Mr. O. Heinze of Lowell, Mass. The wheel contains four magnet coils, outside of which are four segments comprising part of the tread of the wheel, and a ring of [illegible] per cent manganese steel is clamped between them and the wheel proper to send the magnetic circuit into the rail. The energizing of the magnets is so timed that each succeeding section of the wheel is attracted to the rail just in advance of making contact with it, so that the device besides giving increased adhesion also assists acceleration. The current is cut off from each given segment as soon as it is no longer in contact with the rail. Tests have been made on a truck equipped with two 3 horse-power 600-volt standard railway motors and weighing 13,000 pounds. With the traction due to weight alone the motors developed a drawbar pull of [illegible] 00 pounds. With the wheels magnetized the tractive effort was increased to 4,500 pounds, or more than [illegible]00 per cent. The inventor does not claim to increase the traction by such a liberal percentage on an ordinary car, but states that a car equipped with his device should be able to mount grades that are otherwise impossible without a rack.



The masonry of the main arch was laid in eight independent courses.



The arch has a clear span of 262 feet 9¼ inches; it stands 217 feet clear of the river.

BUILDING THE MONTANGAS MASONRY ARCH BRIDGE.

OUR MARVELOUS AUTOMOBILE INDUSTRY

If ever an industry has grown by leaps and bounds, surely it is that of making motor cars. Even the bicycle in its palmiest days did not produce machines whose total value for ten years could equal the truly enormous sum of money represented by the automobile products made in the United States between 1895 and 1910 Mere figures tell but little For that reason we have presented on the front page of this issue a graphic illustration, in which the wonderful strides made in the manufacture of motor cars are tellingly depicted These strides are all the more remarkable when it is considered that the industry had to weather the severe financial depression of 1908, a period which was one of the most critical in the recent financial history of this country

Considered merely from the standpoint of money, the automobile industry in this country presents a most wonderful spectacle The total estimated value of automobiles to be manufactured in 1910 is $237,000 000 When the industry was born in this country, which was in 1895, the estimated value of the machines turned out was only $157,000 In the brief space of twelve years therefore, we have created an industry whose annual product is valued at millions The intermediate stages between 1895 and 1910 show a growth which is stupendous The stage from 1895 to 1899 marked an increase in the total value of nearly a million dollars, the actual value of automobiles manufactured in 1899 being $1,290,000 Still more remarkable is the development from 1899 to 1903, for the valuation of the automobile product in this country increased nearly sixteen fold in that time, the actual value of automobiles produced in 1903 being $16,000,000 Remarkable as that increase undoubtedly was it was almost equaled by the interval from 1903 to 1907, for in 1907, $105,000 000 worth of automobile machinery was manufactured From the year 1907 to 1910 a 100 per cent increase is to be expected In other words, in these three years the mere increase in value of the automobile industry will be greater than the total value of the industry in the year 1907

An industry which has grown with such startling rapidity and which is valued at so princely a sum, naturally gives employment to an army of mechanics, all of them skilled men handsomely paid Thus we find that the mere wages paid for mechanics in 1910 will amount to about $100 000,000 The chauffeurs who drive the many cars which were in use in 1910 will earn $25,000 000 at the very least in 1910

The number of automobiles produced is nothing short of staggering If all the cars of 1910 were placed end to end, they would reach from New York to Pittsburg, a distance of 438 76 miles This output of 200,000 is three times greater than that of 1907, considered from this linear standpoint, for the automobiles of 1907, had they been placed end to end, would have extended from New York to Harrisburg, a distance of 191 95 miles Compared with this, the 13,333 automobiles manufactured in 1903 seem exceedingly small, although as a matter of fact the machines for that year, had they been placed end to end, would have extended from New York to New Brunswick, N J, a distance of 29 25 miles Even this, small as it seems in comparison with the gigantic production of 1910, is huge when we consider that between 1895 and 1899 the 670 automobiles produced in this country would have extended only from New York to Jersey City, a distance of 1 46 miles.

Had all the automobiles made in 1910 been converted into a single huge machine, the result would be, as our front page illustration shows, a car which would be longer than the steamship "St. Paul," measuring 554 feet from stem to stern Even the output of 1899 had it been thus converted into a single machine, would have been longer than the "St. Paul" The machines of 1903 similarly considered would have been three-quarters as long The output of 1895-1899 is, of course, vanishingly small in comparison with this gigantic trans-Atlantic steamer

Naturally an industry of such Titanic proportions must be capitalized at millions. On the whole, it is safe to say that the actual capitalization of the automobile manufacturers is about $250,000,000 The output for 1910 alone will surely exceed 200,000 cars. Even now there are over 150,000 automobiles in use throughout the country The actual number of employés in the industry is 125,000 in motor-car factories, with employés in parts factories reaching not less than 40,000, a total of 165,000

Hand in hand with this increase in money value, we find improvements in manufacturing processes. Five years ago, where a man would have paid from $2,000 to $2,500 for a touring car, or $850 to $1,200 for a runabout he scarcely expected to get much in the way of durability, or if he did, in the exuberance of unsophisticated anticipation, he was almost sure to be disappointed before he had used the car many days. When we recorded the automobile runs of those days in these columns, we usually had to recite a series of troubles of various sorts, chiefly with tires carbureters, ignition devices, as well as breakages and imperfect functioning of valve mechanisms, shafts, gears, chains, steering knuckles, driving axles, and other vital parts. Contrasting this condition with the results of the Glidden Tour of 1909, we find that thirty cars took part in that run and finished an arduous trip of 2,640 miles in 15 days, at an average speed of twenty miles an hour during the daylight running periods, without making a single involuntary stop That tells the tale of the wonderful technical improvements which have been effected in the brief space of a few years It is rarely indeed that repairs are made during runs nowadays. Occasionally a brake, a carbureter, an ignition system, may have to be adjusted, or a tire may blow out, but the cars operate smoothly and trustworthily

The introduction of special grades of steel, aluminium, vanadium, and babbitt, all of them endowed with definite physical properties peculiarly suited to the requirements of automobile manufacture, have wonderfully improved the quality of the motor car Nickel steel and chrome-nickel steel are now used in crank shafts, transmission shafts, driving axles, driving and differential steering gears, steering knuckles, and similar parts, manganese-bronze, phosphor-bronze, and various aluminium alloys find their places in crankcases gear boxes, steering gear housings, and parts demanding great stiffness combined with light weight.

The automobile industry is very largely responsible for the discovery of the physical properties of chrome-nickel steel and vanadium-chrome steel under different modes of heat treatment and for the introduction of special tool steels required to work them, and has thus indirectly benefited the metallurgical industry of this country As a result of the employment of these new steels in the sliding gear sets, by way of illustration, it is now possible to transmit the 40 and 60 horse-power of the modern touring car with smaller and lighter gear sets than were used in cars of 12, 15 and 20 horse-power five years ago, and that with much greater certainty against breakage and the practical elimination of the mangling of the ends of the teeth by meshing and of wear due to contact under load All this improvement in quality, plus infinitely more grace in general lines and in comfort to the passengers, is offered to the buyer almost at no advance in cost over the ungainly, uncomfortable, and poorly-equipped cars of six and seven years ago It is safe to say that a great proportion of the automobiles manufactured in 1910 will be low priced cars The car that could be bought a few years ago by the man of moderate income required close attention Automobiling at that time was unquestionably a diversion for the rich. Nowadays a man of moderate means can purchase and use a car at an expense that is well within the bounds of reason

In the early days of the automobile industry, the manufacturer was under the necessity of making all his parts, to-day the factories actually making even 75 per cent of the parts that they use are in small proportion to the number of producers It is to these changes that the excellence of the medium priced automobile is largely due There was a time when an assembled car was undoubtedly open to suspicion, for however desirous a maker of its parts might be to do good work, he had neither the knowledge nor the facilities that would make it possible These same companies now possess enormous plants. Their designers and equipment are the best obtainable and their products embody the latest and best in practice, workmanship, and material Assemblers now have at their command parts of a high degree of excellence, and can buy them at prices far below those charged for the weak and faulty product of former years.

When a manufacturer turns out twenty thousand cars a year it is not only justifiable but necessary for him to invest very considerable sums in special machinery of all kinds that for a smaller output would be inadvisable One manufacturer has spent $40,000 for dies to produce a rear axle housing, on a production of one thousand cars, the charge against each for this would be $40 With an output of twenty thousand cars, however, the charge of $2 against each is little enough for the purchaser to pay for so excellent a feature

A recent development that illustrates the endeavor to reduce manufacturing costs is the establishment by some of the leading producers of assembling shops at the large centers. To these are shipped parts in sufficient quantity to build the cars required for that locality, and as there is no equipment of machine tools, the expense is slight. The freight rate on unassembled parts is much lower than on complete cars, and the saving effected in time and convenience as well as in money makes the system a satisfactory one.

Vast as the automobile industry is, huge as is the value of its output, it must not be supposed that the profits are illegitimate. It is safe to say that the present-day manufacturer of medium-priced cars makes no more than a legitimate profit. One of the largest producers stated recently that his profit on a $1,000 car is less than $100, surely not excessive when one considers his enormous investment in material and parts, his really vast equipment of machine tools, and his labor expense.

It has been said that any average engineer can design a car to sell at $4,000, but that the greatest skill is necessary when the selling price is to be less than $1,000 Perhaps that may account for some of the exceedingly clever designing in the low-priced cars.

The scene of the industry has shifted in the years from 1895 to 1910. Much of the early experimenting in motor cars and early manufacturing was done in Buffalo, Tarrytown, Marion, N J, Bridgeport and Hartford, Conn., Philadelphia, Pa., and other Eastern States. At present Michigan leads all the States in motor-car manufacturing, for that State last year made 112,000 of the total production of cars for 1909. Four other States adjoining it will produce 75,075 machines at least. The Middle West may therefore be said to be the real home of the automobile industry at the present time It controls not only the car-making industry, but the making of tires, parts, and accessories as well, a condition which is primarily due to the industrial enterprise of the smaller communities of the Middle West, who have given land and in every way furthered the making of automobiles. It must also be considered that the makers of automatic machinery are very largely situated in the West, for which reason the better class of skilled labor is there to be found Lastly, the shifting of the industry from the East to the Middle West has been caused in part at least by the fact that the raw material is there put through its first and second processes, as in the case of rubber, steel, leather, wood, brass, and the like

That the Middle West is undoubtedly benefited by the influx of automobile manufacturers can be shown by the wonderful increase in the population of some of the smaller towns. The influx of 2,000 to 5,000 families has doubled and trebled the populations of such cities as Flint Mich, and Newcastle, Ind, and greatly enhanced the value of real estate. Towns which were practically unheard of before the automobile entered into our daily life are now thriving centers of industry Communities with a population of only five or six thousand have their names brought home through the magazine advertising pages to millions and millions of readers, simply because they are the sites of large automobile plants.

Cost of Various Methods of Illumination.

The Frankfurter Zeitung publishes the following remarkably complete table of the cost of various methods of illumination

	Cost of 100 normal candle hours. Cents
Washington light	0 238
Flaming electric arc	0 381
Mercury vapor lamp	0 595
Incandescent gas light	0 595
Incandescent petroleum light	0 714
Direct current electric arc	0 942
Osram, zircon and tungsten lamp	1 190
Kerosene burner	1 666
Osmium lamp	1 785
Tantalum lamp	1 904
Incandescent alcohol lamp	1 904
Alternating current electric arc	1 904
Nernst lamp	2 023
Small arc lamps	2 142
Acetylene	2 856
Carbon filament	3 808
Argand gas burner	3 808
Fishtail gas burner	5 950
Stearin candle	26 180

The Washington lamp is an incandescent lamp which burns petroleum under pressure

In compiling this table the following average prices for fuels and electrical energy have been employed

Kerosene	2 38 cents per pound
Alcohol	4 33 cents per pound
Stearin candles	16 23 cents per pound
Gas	107 87 cents per thousand cubic feet
Acetylene	809 07 cents per thousand cubic feet
Electric energy	11.90 cents per kilowatt hour.

According to plans formulated by Rear-Admiral Cowles, chief of the Bureau of Equipment of the United States navy, and submitted by him to Congress, wireless apparatus of the latest type is to be supplied to all the new vessels of the navy, including destroyers and all auxiliaries, as this latter class of vessel has proved very valuable in establishing wireless chains across long stretches of ocean without the necessity of disrupting the fighting fleet. Another shore station is contemplated at Dutch Harbor, Alaska, to provide wireless communication to Bering Sea, connecting with the Cape Nome station, permitting vessels from Nome to lower California to keep in touch with the world. After the contemplated high-powered station in Washington has been completed it is believed similar stations will be found necessary in the following places: The west coast of the United States, the Panama Canal Zone, Hawaii, and the Philippines. With stations at these places vessels will be within call while in practically all waters where naval operations of interest to the United States might be expected. Each station will cost $150,000.

Correspondence.

PFITZNER'S MONOPLANE.

To the Editor of the Scientific American

I have just read with much interest an article in your issue of February 12th under the caption "A Novel American Aeroplane."

The monoplane has always appealed to me as being more consistent with the laws of nature, and therefore more susceptible of continued improvement and eventual perfection, than the biplane. The double or triple planes strike me as being contrary to the examples set us by Nature, the extra planes being a superfluity of which Dame Nature is rarely, if ever, guilty It would be an incongruity for a bird to be supplied with more than one pair of wings, unless the duplex or triplex wings were accompanied by a Siamese-twin or triplicate body As long as there is but one body and one source of motive and controlling power, a single pair of supporting planes would appear to be all that is necessary if the planes are sufficiently extended to support the body at the speed normal to the bird Additional planes do not sufficiently compensate by their increased buoyancy for the increased weight, unwieldiness, and instability I therefore pin my faith to the monoplane as likely to afford an additional illustration of the truth of the Darwinian theory of "the survival of the fittest"

Mr Pfitzner's design, according to my ideas, comes nearer to the ideal heavier-than-air flying machine than anything that has heretofore been brought to my attention. I will be greatly mistaken, and disappointed as well, if we do not hear from his machine ere long as successfully rivaling even the best of the biplanes.

But even Mr Pfitzner's novel design is susceptible of improvement I cannot help wondering why neither he, nor any other aviator as far as I have been able to observe, has adopted what I consider to be a very essential element of stability invariably to be found in the make-up of the denizens of the air I mean the invariable disposition of the weight of the body to the supporting planes. Mr Pfitzner seems to have entirely ignored this principle, like all other aviators, by placing his engine and driver's seat above or on a level with the supporting planes.

Nature, on the contrary suspends nearly the entire weight of the bird below the level of the wings or planes, evidently for the express purpose of securing stability During flight, or particularly while soaring, the extended wings of the buzzard (to adopt a familiar example) are held in a plane slightly above the point of their juncture with the body, while at the same time the head is lowered and extended forward, so as to bring it down to or beneath the plane of the wings While the bird is sailing in a calm atmosphere, the legs and feet are drawn up toward the body, but let a sudden gust of wind strike under one wing and tend to displace the center of gravity, the legs are at once extended in order to lower the center of gravity, and equilibrium is at once restored This seems to me to be a wise provision of Nature worthy of imitation as far as is practicable by the aviator

With the engine, and naphtha and water tanks, as well as the seat of the aviator, rigidly suspended as far as conveniently possible below the planes, the weight acts like a pendulum, the plumb-bob of the mason, or the ballast of a ship, its constant tendency being to restore the equilibrium of the planes the moment the disturbing force is removed And in making a change of direction, if the radius of the curve is abrupt, the tendency of the outer plane to rise on account of its increased speed as compared to the retarded speed of the inner plane will be measurably counteracted With the weights so disposed, the extended planes will act like a parachute, and in case of the sudden breakdown of the engine or propeller would, in conjunction with the usual downward glide of the machine, enable the aviator to alight in an open space "right side up," without damage to either himself or his aeroplane

Were Mr Pfitzner to raise his planes to the tops of the vertical posts, and lower the engine, tanks, and seat to a level with the axles of the carriage, he would find that much less skill would be required to preserve the equilibrium of the machine Possibly the propeller shaft should remain on a level with the planes, but if lowered just far enough to enable the blades to clear the ground, I apprehend he would be able to make a quicker start The tendency to drive the plane upward would assist it in leaving the ground, and, once afloat, that tendency, if persisted in, could readily be counteracted by the proper use of the forward horizontal rudder, without perceptibly impeding the speed of the flyer

I would suggest another scheme for the rudders. Let them be connected together, so they would move in unison When the horizontal rudder is elevated or depressed in order to rise or descend, it would make no material difference if the perpendicular rudder did also rise and fall in a perpendicular plane It would produce no change in the direction In like manner, if the perpendicular rudder should be turned to the right or left in order to alter the course, it would have no influence on the elevation of the machine.

I possess but a superficial knowledge of aviation, and I have no means for investigation or experiment, but I have been intensely interested in the science ever since the Wrights' experiments were first made public The above thoughts came to me as I read and pondered the description of Mr Pfitzner's novel device I make bold to offer them to you for publication if you deem them worthy of being embalmed in print.

Norfolk, Va C E McClure.

THAT NUMBER PUZZLE.

To the Editor of the Scientific American

If your correspondent in the issue of January 22nd will study the following figures, he will plainly see that it is *not* impossible to get 35 sets of 3 out of 1—15, so that no two numbers will be in the same set more than once

1— 2— 3	2— 4—10	3— 6—11	4— 9—12	6— 9—13
1— 4— 6	2— 5—11	2— 7—12	4—13—14	6—10—14
1— 5— 8	2— 6—12	3— 8—13	5— 6— 7	7— 8— 9
1— 7—10	2— 7—13	3— 9—14	5— 9—10	7—11—14
1—12—14	2— 9—15	4— 7—15	5—14—15	10—11—13
1— 9—11	2— 8—14	3—10—15	5—12—13	8—10—12
1—13—15	3— 4— 5	4— 8—11	6— 8—15	11—12—15
1— 2— 3	2— 4— 6	3— 5— 6	4—10—14	6— 9—12
1— 4— 5	2— 5— 7	3— 8—11	4—11—15	6—10—15
1— 6— 7	2— 8—10	3— 9—10	5— 8—14	6—11—14
1— 8— 9	2— 9—11	3—12—15	5— 9—15	7— 8—15
1—10—11	2—12—14	3—13—14	5—10—12	7— 9—14
1—12—13	2—13—15	4— 8—12	5—11—13	7—10—13
1—14—15	3— 4— 7	4— 9—13	6— 8—13	7—11—12

If he will carefully inspect the 30 sets of numbers presented by him in the same issue, he will discover that the numbers 4 and 6 are twice paired, leaving only 29 sets without duplicates

Milwaukee, Wis Lewis Sherman

REBUILDING THE "IDAHO" AND "MISSISSIPPI."

To the Editor of the Scientific American

As one of your readers, I have been following with interest the proposals put forward by various gentlemen regarding the reconstructing and rearming of the different types of pre-dreadnought battleships in our navy

In the March 5th number of your paper you published a letter from Mr W W Bass concerning a proposed rebuilding of the battleships "Idaho" and 'Mississippi' so as to make them nearly equal to the Louisiana" class. One of the objections put forward was the impossibility of establishing a 10 inch gun in a turret built for two 8-inch Why not avoid this difficulty by leaving the eight 8 inch guns already mounted where they are and then to increase as much as possible the 7-inch battery below? This would make these ships even more similar to the "Louisiana '

I do not believe that the cutting in two of a battleship would entail very great difficulties as a few years ago a White Star liner was cut in two and a new bow built on the original having been destroyed by an accident A torpedo-boat destroyer of the British navy also was rebuilt in this manner

But if it was deemed too expensive to build this section as proposed, would it not be feasible to sacrifice a few 7 inch guns and re-engine the ships with turbines of greater power thus attaining the extra knot and a half necessary to bring them up to the "Louisiana's" speed standard without the cost, time, and labor of totally rebuilding them?

Leonard Opdycke

New York, March 21, 1910

[The "Idaho" and "Mississippi" are so much shorter than the "Connecticut' that there would be no room for the mounting of additional 7-inch guns It would be useless to install turbines in these ships without increasing their length and the cost of both changes would not be warranted by the advantages of additional 7 inch guns and the greater speed secured thereby The deficiencies in these ships are due to the action of Congress in limiting the displacement to 13,000 tons —Ed.]

Death of Alexander Agassiz.

Prof Alexander Agassiz died on the steamer "Adriatic" on March 29th, while on his way to New York Hardly less famous as a scientist than his father, he was noted not only as a biologist but as a mining engineer financier, teacher and man of the world In his life he combined the activities of president of the Calumet and Hecla Mining Company and director of the Museum of Comparative Zoology at Harvard, founded by his father Prof Agassiz was born in Neuchatel in 1835 and did not come to this country until he was fifteen His early education was received in Europe, although he was graduated from Harvard with the class of 1855 He started out in life as a civil engineer, and did much valuable work as assistant on the Atlantic Geodetic Coast Survey His work in that field naturally drew his attention to the natural sciences. He began to collect fishes for his father, and thus was induced to follow in his father's footsteps. After that his activities were almost equally divided between zoology and mining

A study of the copper mines of Peru and Chili led him to a survey of Lake Titicaca, and also to collect Peruvian relics, which are now lodged in the Peabody Museum at Harvard Five years of his life, from 1876 to 1881 he spent in deep-sea dredging His biological survey of the waters of the Gulf of Mexico and the Caribbean Sea is still regarded as classic

His exploitation of the Calumet and Hecla mines to his profit secured the means to gratify his father's ambition, the erection of the great Harvard Museum of Comparative Zoology

He made by his persistence and ability in argument the development of the Lake Superior copper territory on Keweenaw Point (and now later traced to the mainland) a certainty

Death of Hermann Moedebeck.

Oberstleutnant z D Hermann Moedebeck died recently With him there has passed away one of the most ardent advocates of aero-navigation Thanks to his efforts the Deutsche Verein fuer Luftschiffahrt included in its programme meteorological measurements. As a young lieutenant, Moedebeck became a member of the Deutsche Verein zur Fordorung der Luftschiffahrt. As a captain he founded in Strasburg the Oberrheinische Verein fuer Luftschiffahrt, and published its official organ, Illustrirte Aeronautische Mitteilungen, now the official organ of all the German aeronautic societies In 1907 Moedebeck was promoted to Oberstleutnant A year later he retired from active army service in order to devote his entire time to aeronautics He was a member of the International Commission for Scientific Aeronautics and a charter member of the International Commission of Aeronautic Maps It was only recently that he founded an aero Luftflottenverein fuer Berlin und Brandenburg

Death of Galen Clark.

Galen Clark, who died in Oakland Cal, on March 24th, had been known for the last half century to almost every tourist who has visited the Yosemite Valley While on a hunting trip in 1857, he discovered the great redwood grove at Mariposa Soon after that Clark devoted much of his time to exploring the upper heights of the Sierra Nevada Mountains, and made known to the world much of the beauties and wonders of the big tree groves and of Yosemite

The Current Supplement.

In the current Supplement, No 1788, Mr P M'N Bennie reviews the recent work which has been done in the electrical reduction of iron and steel There is much confusion with regard to dyestuffs and the colors which they impart to the textile fabric, and this confusion Prof Otto N Witt seeks to remove Some very interesting novelties in toys are described and illustrated Lieut. John C Solely exhaustively discusses the oil fields of the Gulf of Mexico In an article on the South Pole will be found mentioned the various schemes which have recently been put forth to reach the South Pole Prof George E Hale s admirable consideration of solar vortices and magnetic fields, in which he reviews his recent study of the sun is concluded Halley s comet is now visible to the naked eye just before dawn in the eastern sky, for which reason Mr George F Chambers's most thorough article on this interesting wanderer is published with peculiar timeliness One of the most important articles in the Supplement is Mr Aston's account of the recent Olympia aero exhibition by far the biggest of its kind which has ever been held in Europe

According to the Engineering Record improved boiler performance has been attained at the Anderson station of the Indiana Union Traction Company by preventing the leakage of air from the ashpits around the ends of the chain grates into the flues. This is accomplished by first fixing a 4 inch extra-heavy pipe across the furnace 8 inches from the rear of the grate, with its lower surface 3½ inches above the top of the grate There is a span of about 10 inches between the center of the pipe and the rear fire box wall, which is covered with a course of fire-brick This shelf prevents the passage of air, while the pipe holds back unconsumed coal until it has been burned into ash, which the grate can carry back under the pipe in the desired manner Inside the 4 inch pipe is one of 1 inch diameter running from one end nearly to the other Cold water is admitted through the small pipe and flows back through the large one, the rate of flow being adjusted so that its final temperature is just under the boiling point The hot water is discharged in a way that permits its condition to be inspected, into a header delivering it to the hot well.

OUR SEACOAST DEFENSES

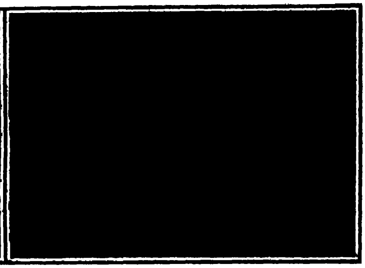
BY CAPT. H. E. CLOKE, U. S. ARMY

When the Constitution of the United States was framed creating a republican form of government provisions were made for the creation of military and naval forces and for the existence of State troops for the purpose of repelling of invasion

Owing to the fact that access to our coast fortifications has in years past been prohibited to the citizens of this country it is not surprising how few men understand the method of firing a high powered gun or a modern mortar For this reason the following description illustrated by the different drawings is given

I last en fo I ... rapid fire gun It can actually be fired more rapidly ... 100 p r ... at 6 000 yards range several times

Positions of detachment at command "Load" for 6-inch disappearing rifle.



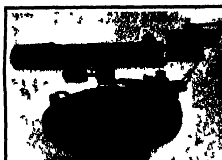
The range finder is the eye of the system while the telephone and telautograph are its nerves The hitting power of a battery absolutely depends upon its range finder

A range-finding room. (B' station)

No better service could be rendered to the country and there is no service that should appeal more to the patriotism of our State troops than this and particularly the troops of those States which border the coast to be defended Our organized State militia and the various labor organizations should be attracted to the subject of coast defense for the reason that men in such organizations are unable to leave their families and business interests and enlist for general service in time of war If they were organized as a defensive force for the protection of their homes against invasion the defensive forces of the State and country would be increased by a body of men of a high order of patriotism and intelligence

When one contemplates the cost our coast defenses certainly do appear to be an expensive investment For example a 12 inch gun complete costs about $14? 000 and as there are about one hundred of these guns mounted in our coast forts the cost of the 12 inch guns alone amounts to $1? 000 000 On the other hand we must remember that this sum does not equal the cost of two Dreadnoughts It costs about $00) every time one of these guns is fired with an armor piercing explosive shell but one of these shells if directed at the proper point on a modern battleship will inflict hundreds of thousands of dollars worth of damage Although one submarine mine charged with a hundred pounds of nitro glycerine costs about $?00 it may if exploded underneath a battleship send many millions of dollars to the bottom of the sea On the other hand the life of the 12 inch guns without re rifling is only about 240 rounds that is to say firing one shot every thirty seconds (the time of fire of a 12 inch rifle) the gun becomes useless after a two hour engagement

Let us consider the enemy's fleet to have been sighted on the horizon and headed under full steam in column formation for the entrance of a harbor The attack is being made during a late hour of the night On the discovery of the leading ship by the powerful



... the telescope of this instrument are vertical and horizontal cross hairs As the eyepiece of the telescope is elevated ... a ship ... the base ... automatically This instrument is the invention of Maj ... Lewis of the coast artillery corps

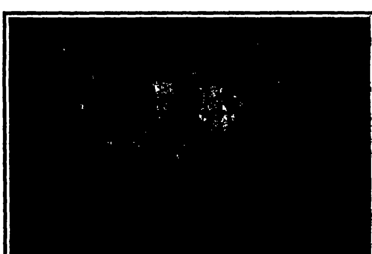
Lewis position finder.

searchlights of the defense the battle commander directs the sounding of call to arms Within ten seconds every soldier is at his station or post for duty for in case of imminent attack the men sleep at the guns The battle commander then notifies the fire commanders by telephone of the approach of the fleet The fleet would probably be picked up at ten or twelve thousand yards At this range all the heavy batteries including mortars are directed on the leading ship The probability of hitting her by this means would of course be greater than if the fire were dispersed All guns attack the side armor and turrets of a battleship while the mortars attack the decks The searchlights of the different fire commands are now concentrated on the leading ship while the battle command lights are searching for undiscovered ships

In order to fire a modern 12 inch gun the following data must be accurately determined

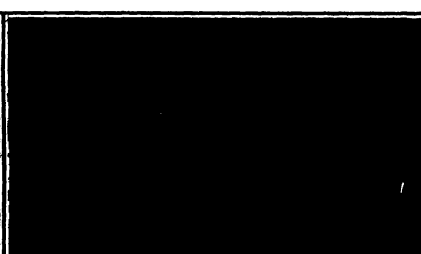
The elevation to be given to the gun (which is a direct function of the range) and the amount of deflection to be set on the sight If the gun were merely set for the range from the gun to the target the probability of hitting would be very small The errors that enter into the range function are as follows 1 The accelerating or retarding component of the wind 2 The variation of the height of the gun above water level due to the height of tide 3 The variation of the resistance offered by the air due to its density 4 The variation of the initial velocity of the powder due to temperature or other causes 5 The change of the range due to the speed of the target These corrections must be applied to the range with lightning rapidity It is accomplished by the use of certain mechanical contrivances which are located in the various fire control stations of the fortress

The deflection correction to be set on the sight is the algebraic sum of the component of the wind the drift and the speed of the target and it is determined by means of mechanical devices located in the plotting rooms The following then would be the method of determining the range and deflection to be sent to the guns by telautograph or telephone At the simultaneous ringing of the bell in the primary



It is in this room that specially trained men determine from data received from the range finders the course of a target and its predicted position This predicted range is sent to the guns of a battery and by the ringing of a bell the predicted time is announced and the gunner fires by ... device

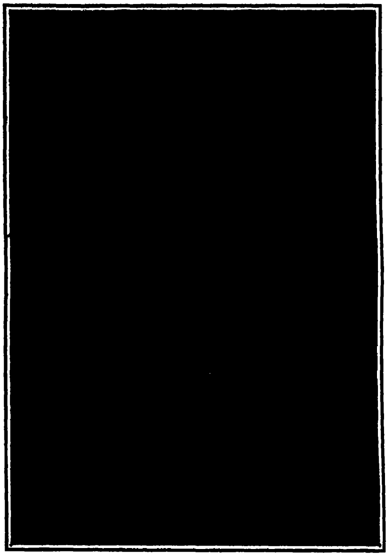
A plotting device.



These weapons attack the most vulnerable part of a ship—the decks. Each one is loaded with a 1,000-pound shell which is filled with about 100 pounds of high explosive which detonates on striking Sixteen of these mortars are fired at once. Their extreme range is 12,000 yards. At long ranges they are more accurate than a gun.

Positions of detachment at command "Posts" for 12-inch mortars.

and secondary stations, the observers at the instruments read the azimuth angles at the base ends. These angles are immediately plotted on the plotting board, and the position of the target with reference to the center of the gun is determined. At the expiration of 15 seconds, the bell again rings, and the target is again plotted. The course of the ship is then accurately determined and, by means of a mechanical device on the gun arm, the amount the target has changed in azimuth, due to its speed, is determined. The last range read is now set on a device called the range board. This device is practically a graphic adding and subtracting machine. The corrections above referred to for atmosphere, wind, tide, etc., are here applied, and the resultant correction (a reference number) is set off on the gun arm of the plotting board, and corrected ranges are now sent to the gun by telephone or telautograph. This range is called the corrected predicted range to the target. It is predicted for an interval of 15 or 30 seconds ahead. It is now plugged in on the time range relation board which is in full view of the range keeper at the gun. The range keeper keeps the range disk continually set at the corrected range (as observed on the time range relation board) such that the gun can be fired at any time. The deflection correction is obtained by the use of a device called the deflection board. This, as in the case of the range board, is an adding and subtracting machine which determines the number of degrees and minutes of deflection to be set on the sight due to wind drift and speed of target. The drift is determined by ballistic calculations, and the curve is constructed on a metal leaf on the board. The velocity of the wind is determined at the meteorological station by means of an anemometer and is received at the plotting room by means of an electrical device called the aeroscope shown in the drawing. The azimuth of the wind is also sent by the same means. The components in the direction of range and deflection are determined by means of a device called the wind component indicator shown in the picture. The atmosphere correction is determined in the meteorological station and is sent in over the aeroscope. The height of tide is determined by a tide gage. The velocity correction is determined by a device called the powder chart.



Groups of these deadly weapons of destruction are planted across channels to keep the enemy out. They are harmless to friendly ships and are entirely controlled from a casemate on the shore. The new system of submarine mining of our army is a great triumph of electrical engineering. The principles of its operation are kept secret. The high explosive is contained in the floating metal sphere.

A complete submarine mine

(Redrawn from Lokes "The Gunner's Examiner," published by John Wiley & Sons.)

Owing to the fact that these corrections may be either additive or subtractive and that the use therefore of a negative sign tends to confuse the gunners in the plotting room, those corrections to be applied to the range are not sent in according to their actual values but by means of reference numbers. The zero of the sight for example is the number 3. The gunner at the sight therefore would receive a deflection like this 4.25. He simply sets his sight to read this deflection and the gun will then be correctly aimed. It is to be understood that all these fire control instruments and stations are located at obscure places in the fort reservation and are amply protected by parapets of earth and concrete. They are connected with each other by either telephone, telautograph or speaking tube, all of which are laid underground deep enough to insure ample protection from ordinary gun fire.

The fire control system of our coast artillery is also very flexible. If the horizontal base system fails each observing instrument at the primary and secondary stations can be used as a vertical base range finder and the system is so arranged that in case all the range finders except that of the fire commander are put out of action his station can supply all the guns with the necessary data for firing them. Furthermore if all the stations including the fire commander's should be

(Continued on page 316.)

This diagram shows in a general way the arrangement of an up-to-date battery. The position of the enemy is found by observing the angles the ship makes at two observing stations B' and B'' situated at the end of a common base line of known length. These angles are telephoned to the plotting room where the position of the ship is found. From the plotting room the proper elevation, etc., is telephoned to the gun.

From drawing by Master Gunner Kuhn.

A typical battery command.

OUR SEACOAST DEFENSES.

OUR CIVIL DAY

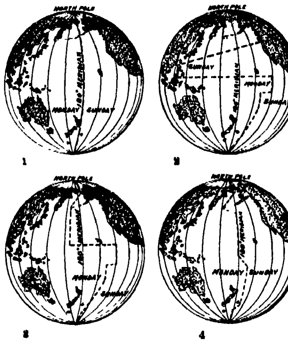
ITS ARRIVAL ON AND PROGRESS AROUND THE EARTH

BY DANIEL ARTHUR

A few generations before our era the "whole known world was only some 2½ million square miles in extent instead of nearly 200 millions as we now know That great observer and geographer Eratosthenes made a noble attempt about 225 B C to draw a map of the "World" He even used lines which looked very like parallels of latitude and circles of longitude These lines were largely based on the speed records of travelers and hence were not very accurate There were no such refinements on his maps as international date lines or time zones His general outline of the 'whole world" was about 90 deg wide east and west by 60 deg long north and south It was all above our equator, and extended only about a quarter of the way around the earth The mouth of the Ganges was farthest east and what is now Ireland was farthest west The Caspian Sea was thought to be an arm of the Northern Ocean, while the lower end of the Red Sea was about the southern limit Knowledge of the rest of the world grew very slowly then, as was shown by the fact that the great Strabo drew a map*of the "World two hundred years later (about 25 B C) and made no material extension of its lines He pushed Great Britain and Ireland farther west and made some radical changes on the northern edge of the Mediterranean, but otherwise those two maps of two hundred years apart are practically the same There is very little doubt, however, that Strabo thought the world to be round, before he died Hence the necessity for a date line was felt even at this early date

While the spherical earth idea was passing through its hundreds of years of resistance some radical observers started it spinning on its axis so to speak. They were bold men, but they proved their case This brought the date line as a necessity closer to us It would almost seem that with a flat disk world" converted into a stationary globe, and later into a rotating globe the date line idea should have suggested itself at once Not so, however, for it appears that when Magellan crossed the Atlantic from the east he passed around South America crossed the Pacific, discovered the Philippine Islands, and went home around the lower end of Africa thus completing a trip around the world This trip was made less than four hundred years ago, yet when the explorers arrived at their home country they were astonished to find that they carried a date on board their ships which was a day earlier than the home date It was soon found that no mistakes were made on the log books as to the time records and that the home calendar was certainly correct The explanation of this seeming impossibility was soon forthcoming, and our date line was born in fact

As no one wanted the line near his home or country, it was put in the most out-of-the-way place possible, where it still stays The 180th degree meridian is in theory where each new civil day is born, but in practice it has never been strictly adhered to Fig 1 diagram 4, shows its location with the deflections of practice as they now exist on the official map at Washington This map was made by the Hydrographic Office of the United States to illustrate its replies to a set of questions sent by the writer. The map, together with the questions and the answers, will be found on a recent Pacific chart issued by the Navy Department To describe the line, commencing at the northern end, it will be seen that the first deflection of practice is to the east, to give the tip of Siberia the same date as the rest of the Russian empire Then after the line passes through Bering Strait it bears to the west, crossing the true line of 180 deg and far enough beyond it to take in all of the Aleutian Islands to the American date, after which it turns back to 180 deg, where it stays until it crosses the equator a few degrees, at which point it again deflects eastwardly to give the Tonga Islands the date of Australia The line then returns to the 180th meridian and continues on that line to the south pole



1 2 3 4

1 Theoretical date line 2 Date line when Alaska took date of Russia and Philippines took date of Spain 3 Date line after purchase of Alaska and Philippines took Asiatic date 4 Present international date line

Fig 1 —The evolution of the international date line

The foregoing is the 'international date line' of practice at the present time, but in former generations the deflections were considerably greater, as for example the one shown in the second diagram of Fig. 1 In this date line Alaska was taken into the day of Russia, to which empire it formerly belonged. The line then took a westerly sweep of thousands of miles to take the Philippine Islands under the date as written in Spain This latter wide deflection was afterward turned back or corrected by the action of the Governor General of the Philippines when he decreed that December 31st, 1844, be reckoned as January 1st, 1845, to bring those islands into accord with the date of the countries east of the Cape of Good Hope. When Alaska was acquired by the United States, the date line was transferred west of that territory or into Bering Strait. These two radical changes made the line of practice look more like the third diagram in Fig 1 Refer to Fig. 2, which is intended to show the entrance of time on our globe The picture illustrates a mechanical delivery of our civil day, month, year, or century by means of an equatorial tape Let us assume that the earth is stationary and that this tape enters and departs under the date-line rollers as shown. If the tape had a speed of about 1,040 miles per hour and was properly marked in hours, days, months, etc., it would show just how our civil day enters the earth and progresses around it with a constant motion The illustration shows the front end of the twentieth century as having completed 18 hours of its first day on earth, leaving only 6 hours of the nineteenth century to glide toward the line and off, to no one knows where The front end of January 2nd will have reached the earth's time door to enter it just as December 31st steps out, as it were Then we have the twentieth century all over the earth with January 1st reducing its equatorial width at the rate of some 17 miles per minute and January 2nd growing broader at the same velocity This of course is assuming that time is entering normally and not by the arbitrary intermittent steps that we will call the twenty four way stations of our civil day This latter system is in successful operation in the United States and two or three other leading nations, China being one of the more recent converts to the hourly zone system *

Fig 3 shows the earth with the hourly time belts or zones outlined from pole to pole. The lines drawn are 15 deg. apart and represent the boundary lines of these zones and not their centers. Fig 4 is the same example as viewed from the north star In both illustrations the United States are outlined in approximately the correct location, so as to show the theoretical boundary lines of the hourly zones as applied to that country Now in these two illustrations let us assume that the system has been adopted in all parts of the world Commencing with the prime meridian at Greenwich as the center of a zone bounded by lines 7½ deg east and 7½ deg west, the completion of such a set of lines would give us just what is drawn and what our United States are actually using in theory To illustrate mechanically the delivery of time on this plan, our equatorial tape is intermittent in its action, that is to say, it jumps 1,040 miles and then stands still for an hour, which means that on the twenty-fourth jump on any day of a given name, that

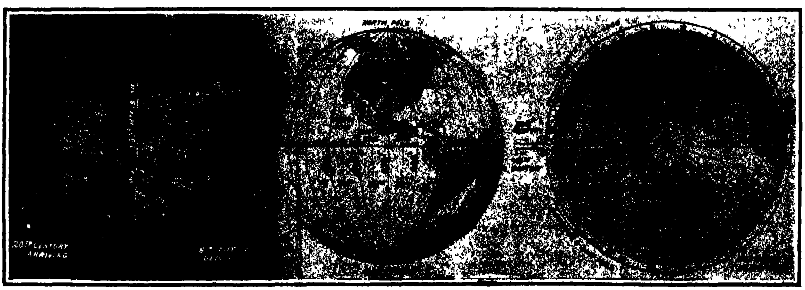


Fig. 2. Fig. 3. Fig. 4.

How the twentieth century was ushered in—a mechanical parallel.

OUR CIVIL DAY—ITS ARRIVAL ON AND PROGRESS AROUND THE EARTH.

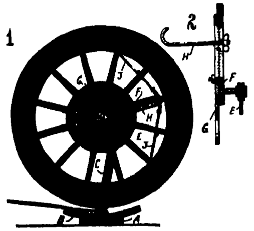
(*Continued on page 367*)

* Since writing this article it has come to my notice that Chili of South America has given up local time which was 17 minutes ahead of United States eastern zone and, to quote the Horological Journal, the Chileans were enabled to live the same 17 minutes twice over The change was accomplished by firing a gun at 12:17 A. M on a given day and calling it midnight. This means that New York city or Washington, D. C., may cable messages to Chili without having to take note of any difference in time.

Patent Department

NOVEL AUTOMOBILE PUMP

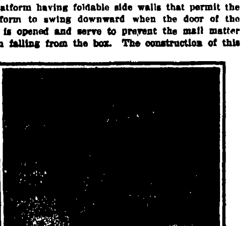
Pictured in the accompanying engraving is an interesting form of pump, that may be used for inflating an automobile tire. The device is arranged to be operated by the automobile itself It consists of a base *A*, on which is mounted a jack used to raise an automobile axle so that the wheel will clear the ground The base *A* carries a shoe *B*, which is designed to assist in positioning the automobile wheel with respect to the pumping device before the jack is operated to raise it The pump is indicated at *C*, and is mounted to rock on a bolt *D* The pump piston *E* is connected to the automobile wheel by a device shown clearly in the cross-sectional view (Fig. 2) A slotted plate *F* is provided with teeth adapted to engage similar teeth on a slotted plate *G* The plate *G* is provided with a crank pin, to which the piston rod *E* is connected The plate *G* is provided with an apertured extension, adapted to fit over the axle of the automobile wheel The plate *F* is attached to one of the spokes of the wheel by means of a hook *H* while a pair of hinged braces *J* are used to connect it with two more spokes of the wheel In this way a rigid connection with the wheel is secured By loosening the thumb nut on the hook *H* the plate *F* may be moved up or down on plate *G* so as to adjust the parts to wheels of different sizes. The distance from the crank pin to the center of the wheel however, is fixed In use the automobile engine is operated to rotate the wheel, and this action carries the piston up and down in a cylinder, the latter rocking back and forth to accommodate itself to the lateral throw of the crank pin A flexible tube connect the pump with the tire that is to be inflated By this arrangement a tire may be inflated very rapidly, and the inflation carried to a further degree than is possible by the manual operation By using a speed attachment of any of the well-known types, the bursting of tires due to excessive pressure may be avoided This inventor of this automobile pump is Dr Richard A. Goeth of San Antonio, Texas.



NOVEL AUTOMOBILE PUMP

COLLECTION BOX FOR MAIL CHUTES.

Collection boxes at the termini of mail chutes are frequently filled to such an extent before the mail is removed that when the collection is made the mail tumbles out of the box on opening the box door and falls to the floor in spite of every precaution taken by the collector To better this bothersome condition a box has recently been devised which is provided with a platform having foldable side walls that permit the platform to swing downward when the door of the box is opened and serve to prevent the mail matter from falling from the box. The construction of this box is clearly shown in the accompanying engraving Fig 1 shows the box door open with the platform *A* swung down horizontally The platform is provided with two side wall plates *B* rigidly secured thereto and a series of sector shaped plates *C* Near the forward edge of each of the plates *B* and *C* is a groove *D* adapted to receive a pin mounted on the adjacent plate, while at the opposite ends the plates of each side wall are mounted on a common hinge pin This permits the side walls to close up somewhat after the manner of a fan to the position indicated in Fig 2 The innermost sector *C* is provided with a lug *E*, which engages a lip formed at the top of the box and limits the outward swing of the platform *A* To prevent the letters from dropping between the sector plates the top of the box is provided with two guards *F* which extend below the upper edge of the plates In use when the platform is lowered the letters in the box will tumble out through the door opening and will be caught by the platform and side walls The inventor of this collection box for mail chutes is Mr R E Edwards, care of T J Kelly, 29 South Eleventh Street, Lincoln, Neb.



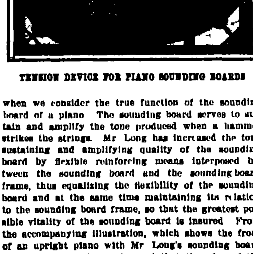
COLLECTION BOX FOR MAIL CHUTES.

A NEW SOUNDING BOARD FOR PIANOS.

The soul of a piano is its sounding board That sounding board is composed of wood carefully selected and carefully seasoned, so that it will remain constant in quality for the many years during which a piano is used. It is arched or crowned against the pressure of the strings so that the strings and the sounding board may vibrate in harmony As the piano ages the sounding board flattens. In an upright piano this flattening is accompanied by "buckling back" or cracking The result is that hard metallic so-called "tin panny," tone so characteristic of old pianos It is obvious that if some means were provided for permanently arching the sounding board against the pressure of the strings, the piano ought to maintain its tone for years without any tendency of the sounding board to sag

The attempt has been made frequently Some success has been attained in grand pianos by the employment of tension rods radiating from a center hub to the sounding board rim, but so far as we are aware no one has ever successfully equipped the upright piano with a sounding board so constructed that it would not lose its arch in time A sounding board of this type which has been successfully applied to an upright piano has recently been invented by Mr Frank B Long of Los Angeles Cal and is illustrated in the accompanying engraving

What Mr Long has done can best be understood



TENSION DEVICE FOR PIANO SOUNDING BOARDS

when we consider the true function of the sounding board of a piano The sounding board serves to sustain and amplify the tone produced when a hammer strikes the strings. Mr Long has increased the tone sustaining and amplifying quality of the sounding board by flexible reinforcing means interposed between the sounding board and the sounding board frame, thus equalizing the flexibility of the sounding board and at the same time maintaining its relation to the sounding board frame, so that the greatest possible vitality of the sounding board is insured From the accompanying illustration, which shows the front of an upright piano with Mr Long's sounding board in position, it will be observed that the edge of the sounding board is subjected to pressure from screw posts interposed between the edge of the sounding board and the heavy back frame The pressure is exerted in such a manner as to cause reflection and condensation of sound waves in accordance with the principles suggested by Helmholtz in his work on "Sensation of Sound" Besides creating this reflecting effect, the pressure post serves the additional purpose of maintaining the crowned sounding board in its original form The back frame supporting the sounding board is reinforced by diagonal tension rods placed across each corner, as shown in the illustration

The edge of the sounding board is rabbeted and glued into a continuous laminated rim built up of hard maple veneers or layers so as to produce an exceedingly strong construction, which, however, is sufficiently flexible to yield under the pressure posts, with a view to equaling the outward pressure on the sounding board resulting from the stretching of the strings over the surface By the use of screw pressure-posts, any shrinkage or expansion of the sounding board and the rim can readily be equalized so as to preserve the tone and even to amplify it The arrangement is such that a proper reflection of the vibrations of the sounding board is obtained, as the strain on the sounding board by the strings is equalized to reflect the tone

As a result of this new combination of sounding board rim and pressure posts a small upright piano can produce a tone which is comparable with that of a small grand piano, and the full round tone of the new upright piano is preserved because the sounding board is maintained in its original arched position

EDUCATIONAL APPLIANCES FOR DISPLAYING OBJECTS.

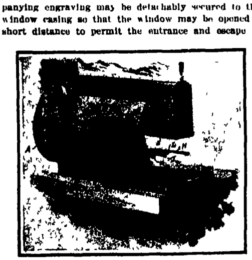
In the instruction of projection mechanical drawing, descriptive geometry, etc, it is important to be

EDUCATIONAL APPLIANCES FOR DISPLAYING OBJECTS.

able to show students a skeleton model of an object, large enough to be seen by an entire class, and which will show front and side elevations as well as plan and bottom views. Heretofore this has been done by using a glass box within which the object was placed, or by using wire screens for the sides of a box, which permitted the teacher to chalk mark the outline of the object An improvement on this system is offered by the invention illustrated herewith It consists of a stand provided with axes that have automatic stops at quarter revolutions to arrest the model in various positions The apparatus comprises a vertical shaft *A*, on which is mounted a table *B* that carries a support *C*, provided with a pair of upwardly extending arms The support *C* has in its lower face four recesses adapted to receive a spring pressed stop pin *D* The recesses are positioned at quarter revolutions of the support. Mounted in the arms of the support is a shaft on which are secured the square blocks *E* and *F* The block *E* is formed with four recesses adapted to receive the pin *G* The blocks are adapted to receive a clamp *H* that carries the display stand *J* Model *K* is shown supported on the stand The display stand may be moved about on three axes which are fitted with index wheels so as to incline or turn the model about to any desired angle The inventor of this educational appliance who is Mr Hermann Hanstein of 2019 Mohawk Street Chicago, Ill informs us that he has used this display apparatus effectively in his own classes

IMPROVED DETACHABLE WINDOW VENTILATOR

The ventilator which is illustrated in the accompanying engraving may be detachably secured to the window casing so that the window may be opened a short distance to permit the entrance and escape of

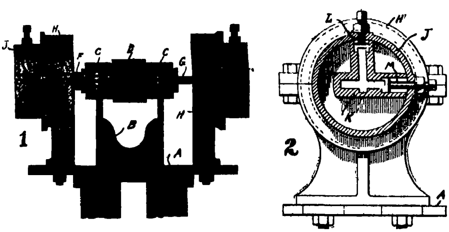


IMPROVED DETACHABLE WINDOW VENTILATOR.

air Furthermore, the ventilator is provided with an automatic damper, which acts to prevent the entrance of unusually strong currents of air and is fitted with a baffle which serves to keep out rain or snow The casing of the ventilator, as indicated at *A*, is quadrant shaped in section, and is fitted into a bracket at each end secured to the window casing. The lower edge of the casing is provided at *D* with a lip that engages the sill of the window Extending lengthwise of the ventilator is a bar *C*, which is formed of sheet metal bent back upon itself to form a holder for two packing strips *D* and *E* which extend in opposite directions The packing strip *D* is adapted to fit against the sash of the window, while the other strip serves as a buffer for the damper At the opposite side of casing there is a vertical extension *F* which serves as a baffle The screen *G* stretches from the base of this extension to the bar *C*, and serves to keep out foreign bodies that may be drawn into the ventilator by the blast of air The damper is indicated at *H*, and consists of a plate bent back upon itself at *J* to form a reinforcing bar while the inner end *K* is weighted so that the damper will normally come to a balance on the axis *L* When the window is raised the damper swings to the horizontal position as indicated, but if a strong draft blows through the ventilator it will strike the under side of the inner part of the damper, lifting it up until if the wind is strong enough, it strikes the buffer *E* When the window is closed it positively closes the damper by bearing against the outer section *H* The brackets on which the casing is mounted are extensible so as to permit of using a standard length of ventilator with windows of different size Each bracket is formed with a spring extension *N*, provided with a lug which is adapted to engage a stop pin on the window sash, and prevent the window from being raised too high Should it be desired to raise the window further it is a simple matter to withdraw the spring catch *M* The inventor of this ventilator is Rolla M Hill care of the Economy Ventilating Co Metropolitan Tower, New York.

TENONING MACHINE.

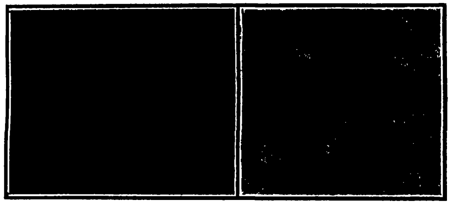
The machine pictured herewith is designed to cut cylindrical tenons on the end of a wooden slat, particularly for use in window blinds. Window blind slats usually are provided with a single central tenon, but there is another type in which two tenons are used, and sometimes the slat is provided with three tenons. The machine is designed to form any of these types of slats. It consists of a base *A* provided with a central bracket *B* formed with two bearings *C* in which is mounted an arbor shaft. The arbor shaft is provided with a pulley *D* between the bearings, and may be fitted with tools, such as shown at *F* and *G* which depend for their form upon the nature of the work which they are to do Opposite each end of the arbor shaft is a pedestal *H* fitted with a head *J* In our illustration the head is broken away at the left hand side of the machine to reveal the interior construction A cross-sectional view of the head is also shown in Fig 2 The head is formed with an interior web *K*, and the web is formed with a pair of channels that intersect at the center of the head At the upper end of the vertical channel and at one end of the horizontal channel is a spring such as shown in Fig. 1, which may be adjusted by means of the screws *L* and *M*, to bear against the work which is placed in the slot. It will be understood that the head *J* is revoluble within the pedestal *H* The pedestal is connected to the base *A* by means of a pair of bolts which pass through slots in the base plate thus permitting of a lateral adjustment In use a slat is inserted in one of the channels in the web *K*, and the end of the slat is brought into contact with one of the cutters on the arbor shaft The pedestal is adjusted laterally so that the center of the slat is out of alignment with the axis of the tool and then when the slat is fed against the tool and the head *J* is revolved a circular tenon will be cut in the end of the slat. If a large tool is used all the wood will be cut away except a single tenon, but if a smaller tool is used a central tenon may be cut, leaving enough wood projecting at each end of the slat to form two more tenons. In this way a slat with three tenons can be formed, and by properly choosing the size of the tool and laterally adjusting the pedestal the slat may be formed with two tenons. The inventor of this slat tenoning machine is Mr José Ojanguren, Calzada del Monte, No 356, Havana Cuba.



TENONING MACHINE.

IMPROVED JACK BLOCK

When the journal bearings or brasses of a railroad car become worn it is necessary to lift the journals by means of jacks so that the brasses may be removed from the car axle, and be replaced with new ones When operating the jack it sometimes happens that the car wheel is lifted with the journal and derailed The purpose of the invention illustrated in the accompanying engraving is to provide a device which will hold the wheel down while the journal is being lifted, and form a level surface for the jack to rest upon The jack block is preferably made of malleable cast iron or steel, and is constructed in the form of a grating with the edges scalloped or corrugated so as to insure lightness without unduly weakening the stuctnre At one end the block is provided with an extension *B*, terminating in a toe *C*, which is adapted to fit over the rim of the car wheel. The jack block is rested on one of the sills of the ties of the railroad, and the jack is seated on the upper face of the block, close to the extension *B* When the journal is jacked up the toe serves to hold the wheel to the rail, relieving the upper journal bearing of the weight of the car and permitting the wedge and brasses to be removed For convenience in carrying the block about a handle *D* is arranged at each side of the body of the block, the location being such that the block is balanced when lifted The inventor of this jack block is Mr James Allen Gray of Cœur d'Alene, Idaho.



IMPROVED JACK BLOCK.

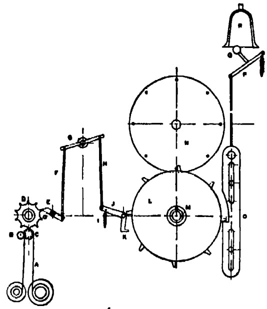
RINGING CHIMES BY PERFORATED MUSIC SHEETS.

One of the pioneer inventors of the automatic piano player, Mr John McTammany of New York city, has devised a system of ringing chimes of bells by perforated paper music sheets, such as are employed in piano-playing mechanisms. Mr McTammany's scheme was evolved as part of a huge memorial to be erected to the memory of the men who fell in the civil war The memorial assumed the form of a monument in which each *State* was to place two bells. To ring so extensive a chime by hand would obviously be a task involving superhuman muscular power. Even the present mechanical and electrical methods would probably fail because of their complexity Hence, Mr McTammany devised the very ingenious system which is here illustrated

The perforated music sheet *A* is guided by a roll *B*, and passes over a grooved roll *C* The pins of a driving wheel *D* are adapted to engage the perforations of the music sheet *A* The pin wheel *D* is operatively connected by means of a dog *E*, a connecting rod *F*, a rock shaft *G*, a connecting rod *H*, and an angle tripper *JK*, with a primary star wheel *L*, which connects with the secondary star wheel *N*. The primary and secondary star wheels *L* and *N* are loosely mounted on collars on their respective shafts, and are housed between separators *M* in such a manner as to prevent them from shifting thereon, yet leaving them free to rotate with the shaft whenever it may be necessary for them to do so to ring the bell-ringing mechanism. The star wheel *L* is provided with teeth on its periphery, which teeth are adapted to engage rods projecting from the star wheel *N*, whenever the star wheel *L* is released by the angle tripper *JK* The teeth of the star wheel *L* engage a slide *O*, connected with a retractile spring-controlled clapper *PQ*, which rings the bell *R* The several shafts illustrated are geared together in such a manner as to cause the several parts to co-operate in definite order

A tooth of the wheel *D* having entered a groove of the feed roll *C* through a perforation in the music sheet *A*, the wheel *D* turns on its shaft. In so doing it engages the dog *E*, which in turn through the connecting rods *F* and *H* trips the angle tripper *JK*, thus releasing the secondary star wheel *L*, which, by the friction of its shaft, rotates into engagement with the slide *O*, thereby pulling the slide down and withdrawing the clapper from the bell When the slide is released by the teeth of the star wheel *L*, the retractile spring of the clapper is released, so that the clapper deals its stroke and rings the bell as the parts return to their normal positions. The wheel *D* straddles the feed roll, and is prevented from rotating except when one of its teeth fits into a perforation of the sheet and into the grooved roll, which turns the primary star wheel one degree.

The playing of the bells can be governed by clock mechanism, so as to strike the quarters and the hours and to play airs at stated intervals.



RINGING CHIMES BY PERFORATED MUSIC SHEETS.

A new form of mercury interrupter has recently been invented in which there are no reciprocating parts, but the interruptions are produced by a ripple formed in a stream of mercury The mercury is contained in a revolving vessel within which a contact-piece is fixed. The mercury is thrown by centrifugal force to the inner periphery of the vessel. At one point the stream of mercury is obliged to pass over a deflector, producing a ripple or wave, and the contact piece dips into the mercury stream at this point as it revolves with the vessel. The frequency of the interruptions may be varied by making the deflector revolve slowly in the same direction as the vessel is revolving, or in the opposite direction, or letting it remain stationary.

OUR SEACOAST DEFENSES.

(Continued from page 301)

put out of action, there are emergency range finders installed on the flank of each battery. This range finder is the Barr and Stroud 9-foot, self-contained horizontal base type. In case these are put out of action ranges must be determined by means of buoys or from observation of fire.

The firing of mortars is far more difficult than that of guns. The detachments at the mortars are completely concealed. These weapons attack the decks of ships, and when fired their location cannot be discovered. They are set for elevation in practically the same manner as guns, but their direction, instead of being set on sights, is accomplished by laying the mortar on an azimuth circle. In other words the mortar is set for an elevation corresponding to the range, and at an angle of direction equal to the azimuth of a predicted position of the target corrected for wind drift, travel, etc. Many authorities considered mortars in past years to be so inaccurate as not to authorize their construction, but within recent years the results of tests and the records of target practice have shown that mortars are of immense value to seacoast fortifications. Several companies in our coast artillery have made as high as 80 per cent hits at ranges of six and seven thousand yards when firing on a moving target having a speed of seven or eight miles an hour and when firing but one mortar at a time. Mortars have a particularly great value in repelling a reconnoissance in force as they can be fired with impunity without disclosing their location.

Another important arm, if not the most important arm of defense in the coast artillery, is that of submarine mines. These weapons are designed to repel an attack when the hostile fleet attempts to come in during a fog or when the guns have been put out of action. The system is so designed as to render these mines harmless to friendly ships and to be under such perfect control of the mine commander as to permit their being fired either by contact or judgment. The electrical principles involved in the control and firing of submarine mines is kept a secret. Ten years ago it took almost two weeks to plant a group of mines. To-day, by the use of mine planters, a harbor can be completely blocked within twenty four hours.

The work that will devolve upon coast artillery troops in time of war will be of the most trying and patience-racking nature.

It is presumed in making this statement that no fleet commander would attempt an open attack or "run by" in broad daylight, but would await the early dawn in a partial fog, when searchlights are useless and the spirit of the men at the guns at its lowest ebb. He would, without doubt, wear the gunners and cannoneers out and try their patience by making many sorties and feints during late hours of the night and early morning before making his final attack. He would also if possible await his attack until cold weather set in and snow had fallen, knowing how dispiriting ice and snow are to soldiers living in tents, as they would have to do during war.

In the harbor of New York, for example, if war were declared all coast artillery would have to live in tents immediately in rear of the guns.

Would it not tend to breed discontent and dissatisfaction among soldiery if they were required to answer "call to arms" every hour during the night for about two weeks in bitter winter weather?

This is the work the coast artillery will have to do when it is called to defend our country's ports from the invasion of a foreign navy.

It will be then that the "brave the

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Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 29, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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active, and the vigilant" will be called upon to show their true colors and "make good."

OUR CIVIL DAY.

(Continued from page 302.)
particular day stays on the world (the entire world) for an exact hour

Let us trace the front end of the twentieth century by this system of progress. We again show it as having reached its eighteenth hour on earth as in the former illustration. That is to say, it has reached the 90th meridian west of Greenwich, or central time, but as central time covers 15 deg. of longitude we have sent the head end of our century to 97½ deg. west, making it arrive there half an hour too soon. We then compel it to stay there until it is a half hour late. Then it takes another jump to mountain time, which lands the 1st of January, 1900, at the 112½ deg. W meridian, and so on. By adhering strictly to the system, let us note what happens when January 1st reaches 180 deg. Of course it must cover the 15-deg. zone, the center of which is 180 deg, thus transferring the "international date line" to 172½ deg. east of prime. The theoretical date line is thereby moved 7½ deg ahead of the 180-deg true line.

Before proceeding with our examination of the ragged edge of time, which local convenience demands on the hour zones or way stations let us glance back at the first diagram of Fig 1 and look at the theoretical line where our civil day enters, then at the former practice in regard to Alaska and the Philippines, then at the line where these two countries changed places, as it were, and finally at the line of practice as now in use (1910). The deflections of practice which appear on this terminal station of time also appear in a constantly changing and more exaggerated form on the way stations (hour zones) We have noticed how irregular the front end of the twentieth century was when it entered the earth Now refer to Figs. 3 and 4 and see what happened to it when it progressed around the earth as far as New York city, that is to say when it reached 75 deg west (the eastern time zone) The dotted outline of the United States enables us to see that Palm Beach, Florida, should be "ringing in" the new year and century in unison with New York city Not so Palm Beach is still on the nineteenth century calendar, and will be for another hour The beach does not belong there, but as the railway managers voted it into central time in 1883, it is still held there by steel rails just as rigidly as the Tonga Islands are put in "to-day" by the steamship lines when they really belong in "yesterday," and as the more westerly members of the Aleutian Islands are kept in "to-day" when they should be in "to-morrow"

I once referred to these zone lines to a friend as imaginary "Imaginary" said he, "I will never forget the time I passed over one when going to California from New York My appetite was running a bit ahead of time, and I was impatiently waiting for the dining car to open up at twelve noon, as the time table said it would. The porter entered my car, and instead of the musical sounds of first call for luncheon on a dining car he shouted' "Set your watches back one hour." If his train had reached El Paso, Texas, under similar circumstances, it might have left the tracks. That is the point where the western time zone overlaps to such an extent that it actually meets an easterly deflection from the Pacific zone. The porter would have then called, "Set your watches back two hours."

To persons who have not looked closely into this complicated subject, the first question that comes to their lips is, Why not keep the date line and zone lines straight in practice as well as in theory? Suppose that you live on Main Street, Machiasville, Maine, where longitude 67½

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(*Concluded from page 307*)

deg west of Greenwich passes right through your front parlor. You will therefore set your hall clock an hour forward and let your little mantel clock stay as it is now Very soon you would like to deflect the line enough to at least pass outside of the walls. Then you see visions of a late delivery of milk for your breakfast, and request that the line sweep in the milk depot, then the railway station, and finally that your office be kept in the same zone of practice. Take another glance at the eastern time zone That little bump on its edge was put there, not only to keep the line out of your parlor, but outside of the State of Maine The mere fact that you and most of your neighbors were unaware of this deflection east of Maine is a proof that the line benders did their work well If a very large percentage of the people of the United States knew that their zone lines were bent, it would be time to bend them into some different form

As some readers might overlook the fact that the astronomical day begins and ends at Greenwich at noon, 12 hours later than the beginning and ending of the civil or common day (the day we sleep and eat and work by), we should make it plain that all the illustrations and remarks apply to the civil one The astronomical day is a clean cut straight line affair that needs no adjusting to practice The users of this kind of a day do not try to thrust its date line aside The observatory at Greenwich was built right on this line and to make it more realistic a bronze tablet is set in stone with prime meridian (Zero Degree) engraved on it so that it may be seen and felt by those who visit the observatory

The Energy of a Coiled Spring.

The old question of what becomes of the energy of a coiled spring placed in sulphuric acid cropped up again before the Western Society of Engineers during a discussion on the conservation of energy Dr Steinmetz gave this explanation on that occasion

The heat produced by the chemical action in a coiled spring when dissolved, is greater by the amount of energy stored in it than if the spring were not under pressure The amount of energy which is stored in compressing the spring in heat measure is so insignificant compared with the energy of solution that one cannot measure the difference calorimetrically but one can prove that the compressed spring produces a greater heat in dissolving than the uncompressed spring, in an indirect manner The measure of the chemical energy is the electrical potential difference If one dissolves iron in an acid and the iron is under strain partly compressed, partly not one finds an unequal corrosion due to local current between the different parts of the iron If there is a local current it means that the different parts of iron have different potential differences against the electrolyte, that is different chemical affinities, and the part under strain is dissolved first, showing a greater potential difference and thus a greater heat produced in its solution Thus, if only a part of the spring were compressed, the other part not, the compressed part would dissolve first in the sulphuric acid by the local current circulating between the two, showing that its solution gives more energy than that of the uncompressed part.

Thomas Edison recently took out a patent on an improvement in his storage battery According to the patent the active material for alkaline storage batteries is impregnated with an oxygen compound of bismuth, by first soaking the mass in a solution of a bismuth salt, then subjecting the material to centrifugal action, and afterward drying The dried mass is then heated in a caustic alkali solution, and finally washed to remove the excess of alkali.

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The Overland

The King of Cars

It requires four factories, employing 4,000 men—turning out 140 Overlands daily—to meet the flood-like demand for these cars. Yet two years ago a hundred rivals had a larger sale.

The reason lies largely in the car's utter simplicity. Its able designer made it almost trouble-proof

He created an engine which, for endurance, is the marvel of engineering

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Washing machine, A. T. Powell	953,227
Washing machine pounder, F. P. Narber	953,542
Watch protector, B. Greenberg	953,727
Water closet, C. H. Moore	953,484
Water closet attachment, J. W. Spalding	953,302
Water cooler, hygienic, A. H. Tyson	953,048
Water heater and clothes boiler, revolving, A. L. Estes	953,321
Water heater or steam generator, A. Anderson	953,453
Water heaters, automatic regulator for, E. P. Nole	953,541
Water meter, F. E. Gamon	953,109
Water meter connection, G. H. Bassett	953,000
Water power paddle motor, endless, A. J. Beelman, Jr	953,465
Welding machine clamp, electric, G. E. Barstow	953,370
Wheel. See Cutting wheel.	
Wheel, Story & Winkel	953,645
Winding machines, movement adjusting device for traverse motion mechanism for, R. R. Matteson	953,398
Windmill, F. C. De Gaire	953,195
Windmill, N. & J. Wagner	953,308
Window bar, G. L. Fox	953,197
Window lock, W. B. Davis	953,523
Wire stretcher, J. P. Carnes	953,257
Wiring, combined cleat and switch for house, B. R. Sargent	953,296
Wireless transmitting system, Muth & Heinkel	953,635
Woodworking machines, split cap for, C. Helbing, Jr	953,206
Wrench, J. Newhauser	953,346
Wrench, A. R. Caril	953,515
Wrench, E. G. Hamilton	953,611
Yoke neck, J. Hullt	953,620

A printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863 will be furnished from this office for 10 cents provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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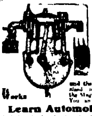

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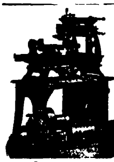

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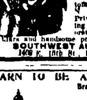

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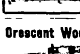

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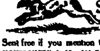

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Cadillac again breaks all records for low cost of upkeep

FIFTY CARS AVERAGE CENT A MONTH

The fifty owners in Dayton, O., territory drive aggregate of 168,580 miles at total cost for repairs of $5 70, averaging 3371 miles per car and 12 cents each for repairs.

Statistics were recently published in New York showing that 75 Cadillac "Thirty" owners had driven their cars 398 884 miles at the amazingly low repair cost of $53 21

It was said at the time that they constituted the most remarkable record of the kind in the history of transportation.

Hard on the heels of the New York achievement comes the claim of a second city showing a still lower cost of upkeep than has ever been recorded.

The 75 Cadillac owners in New York city expended an average for the year of 71 cents per car, while the 50 owners in Dayton, O., and vicinity show a total cost for repairs of $5 70 or the insignificant average per car of 12 cents for the entire year or 1 cent per month per car

The 75 New York owners were not aware that their travels and their expenses were to be made a matter of record and the 50 Dayton owners were likewise unconscious of the fact that they were rolling up a world breaking record.

In both instances the cars were simply driven at the will of the owners anywhere and everywhere There was no particular striving for economy no more than any user would naturally give his car

Of the 75 Cadillac owners in New York 46 had no repairs at all and Dayton shows a more remarkable achievement than this.

Of the 50 Cadillac owners in Dayton territory 45 had no repairs and only five had any expense whatever

Of these five the highest expenditure was that of A. G Rundle of Piqua, O whose car cost him $2 60 during the year, and was driven a distance of 20,000 miles. The next highest expenditure was that of C. F Kettering, of Dayton, who spent $1.50 the next was that of W H Nye of Ironton, O., who spent 75 cents the next, G. W Bahn, of Greenville O who spent 50 cents, and the fifth and and last was Matt Marr of Miamisburg, O., whose car cost the enormous expenditure of for the entire season of 35 cents.

The New York cars traveled a distance approximate to 16 trips around the world and the 50 Dayton Cadillacs traveled a distance equivalent to nearly seven trips around the globe

Dayton comes to the front with some figures on gasoline consumption which are almost equally interesting, as the amazingly low cost of upkeep For instance the average of fuel consumption for the 50 Dayton cars shows 17 miles to the gallon of gasoline for the touring car and 20 miles for the demi-tonneau. One owner particularly writes that he averaged, for 4 000 miles, 21 miles per gallon of gasoline, and over 300 miles on a quart of oil.

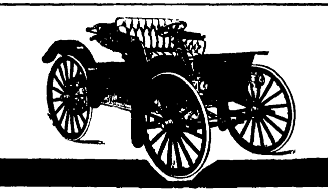
Coming one on the heels of the other these two statements have been among the principal topics of discussion in the motoring world

While it is possible that there may be other makes of cars which can show cases of low upkeep cost in occasional instances, yet it is safe to say that the records here cited, taking one type of car as a whole have never been even approached in motor car history

The manufacturers of the Cadillac, while naturally gratified, take the stand that the experience of New York and Dayton owners is probably duplicated in every locality in the United States where a considerable number of Cadillacs are driven.

They point to uniformly low cost of upkeep as proof of the well-known policy which the Cadillac company has held from its inception, that the perfect car and the car of greatest economy must of necessity be the result of complete standardization.

They contend that New York and Dayton have simply confirmed what has been known to the builders of the Cadillac and to hundreds of users in past years to wit That the Cadillac is an exemplification of scientific design and accurate workmanship which has no parallel in the industry



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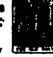

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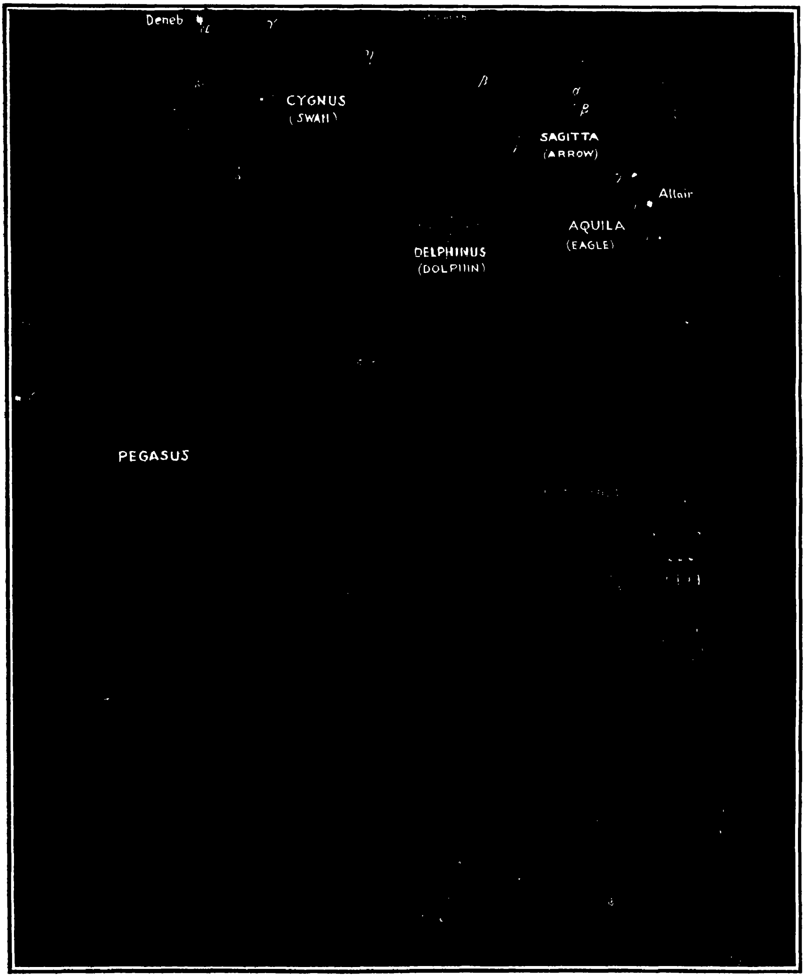
Vol. CII.—No. 16.] ESTABLISHED 1845. NEW YORK, APRIL 16, 1910. [10 CENTS A COPY, $3.00 A YEAR.



Halley's comet is now visible to the naked eye in the eastern skies, just before dawn. Its appearance on May 2nd, one hour before sunrise, is here depicted.

HALLEY'S COMET AT ITS BRIGHTEST.—[See page 317]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, APRIL 16th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE WORLD'S FAIR OF THE FUTURE

In all probability the city of San Francisco will hold an international exposition, or as it is more popularly known, a World's Fair, to celebrate the opening of the Panama Canal in 1915. If the promoters of the fair are willing to profit by the lessons of former expositions, their efforts will be directed to making the coming fair notable, not for mere bulk and area, but for its compactness and the genuine excellence of its carefully selected exhibits. The trouble with many previous expositions has been that they were big to the point of being wearisome and oppressive. A climax in this direction was reached at the St. Louis Fair, in one single building of which a visitor had to traverse nine miles of aisles if he wished merely to walk past the whole of the exhibits. Whatever may be the ulterior motive, the avowed object of these exhibitions is educational. Therefore, they should contain only the most distinctive and valuable results of the world's scientific, industrial, sociological, and constructive work. And in this connection we would ask whether it is not almost an insult to the good taste and intelligence of the millions that are solicited to enter such an exposition, if a large section of its space is devoted to that cheap form of entertainment which was inaugurated by the notorious Midway Plaisance at the Chicago Exposition. San Francisco will have a great opportunity by breaking away from certain false traditions to render this, the latest of the expositions, something better than a mere plaything of the real-estate dealer, the side-show man, and the politician.

GYROSCOPIC EFFECT OF REVOLVING AEROPLANE MOTORS.

There were certain conditions in the recent fatal accident to Le Blon which suggest that the gyroscopic effect of the motor may have contributed to the disaster. He was using a light monoplane of the Blériot type driven by a Gnome revolving motor. The aeroplane, although apparently intact and in good working order, became unmanageable and, turning completely over, fell to the ground. Now, the gyroscopic effect of the 167-pound motor running at 1,200 revolutions per minute, must have been considerable. A sudden turning of the aeroplane to the right or left by the aviator would produce a strong upward or downward gyroscopic tipping tendency in the longitudinal direction. If this tendency were aggravated by a gust of wind, it is conceivable that the aviator would be unable to control the situation sufficiently to prevent a complete upset. At the time of his fall Le Blon was flying above the bay at San Sebastian, Spain, in a high, gusty wind. Is it not possible that the joint action of the wind and the gyroscopic effect of the engine and propeller was responsible for the disaster? The tragic death of Delagrange when he was using a monoplane equipped with the same type of motor suggests that his sudden upset may have been due, in some measure, to similar causes.

GUN RECORDS IN OUR OWN AND THE BRITISH NAVY

We are frequently asked by correspondents to give some comparative figures showing the relative excellence of the shooting in our own and other navies. We would gladly do so, but it is a fact that there is no information regarding the navies of the world more difficult to obtain than this. France and Germany, in particular, never giving to the world the results of target practice. Both the United States and Great Britain, however, do publish such figures. But even here it is often difficult to establish accurate comparisons, because the data which is made public is seldom complete, either the range or the size of the target being frequently omitted, and no statement being made as to whether target or ship or both were moving. However, we offer the following comparison, which is based upon official figures.

The Engineer of London states that the results for the past year have shown that each 12-inch and 10-inch gun has averaged 0.63 hit, each 9.2-inch gun, 1.94 hits, and each 7.5-inch gun 2.47 hits, these being the average number of hits per gun per minute for the whole navy. The 6-inch, 4.7-inch, and 4-inch guns varied from slightly over 4 hits per minute for the 6-inch to 9 hits per minute for the 4-inch.

By the courtesy of Rear Admiral Mason, Chief of the Bureau of Ordnance, we are enabled to publish the average results obtained on all the guns on all the ships taking part in target practice in the United States navy. Whether the ranges and the size of the targets correspond to those in the British navy, we are unable to say. The results are, for the 12-inch guns 0.72 hit per gun per minute, for the 10-inch, 0.76, for the 8-inch, 1.83, and for the 7-inch, 3.13 hits per gun per minute, while the results obtained with the 6-inch, 5-inch, 4-inch, and 3-inch were practically the same as were obtained in the British navy. One 7-inch gun holds the remarkable record of 10.26 hits per minute, while the highest score with the 12-inch gun firing when the ship was under way in smooth water, was 3 hits per gun per minute obtained on the United States ship "Ohio."

CERTAIN ADVANTAGES OF LIQUID FUEL

To judge from a succession of articles which have been appearing in one of the newer and certainly the most noisy of the London daily papers on the use of liquid fuel in the British navy, one would suppose that the virtues of this fuel had only recently been discovered, and that the Admiralty had determined to abolish its coal depots and turn the bunker rooms of its warships into oil tanks. As a matter of fact, any such sweeping substitution of oil fuel for coal is not now contemplated nor ever will be either in the British or any other navy. The natural sources of oil supply are not sufficient in capacity, nor are they so widely distributed, as to make it possible either for the merchant marine or the navies of the world to make a wholesale substitution of oil for coal. Some countries, notably the United States and Russia, possess such abundant supplies that they could, if they so wished, make a much more complete use of oil, and, because of this advantage, it is not unlikely that our navy at least will ultimately make a more extensive use of oil fuel than the navy of any other power.

The advantages of oil over coal are so many that were there as much oil in sight as coal, the new fuel would inevitably supersede the old altogether. In the first place, the higher evaporative value of liquid fuel not only enables a larger quantity of fuel to be carried in the same space, but its use renders possible a decrease of 75 per cent in the number of stokers or fire-room attendants. Being in the liquid form it can be employed as ballast and pumped into remote quarters of the ship far removed from the boiler room and inaccessible for the handling and transportation of coal. For the merchant ship this means not only a saving in the fuel and labor bill, but a positive gain in cargo capacity, while for the warship there is a similar reduction of expense and what is of far greater value, a considerable extension of the cruising radius or the distance over which the ship can travel without replenishing her fuel supply. For the merchant ship there is the further advantage that the bunkers can be filled by a pipe line without the delay, dirt and disorder which accompany the present coaling operations, while for the warship there is the strategic advantage that the ship can take on fuel by a pipe line from a tank ship at any place and in any but heavy weather. Furthermore, the use of oil enables a whole fleet to steam without emitting those tell-tale clouds of smoke which are one of the surest means of betraying its presence to the enemy.

ANCIENT AND MODERN IRRIGATION.

A strong sentimental interest will be aroused by the announcement that the great irrigation works, which at the very dawn of history rendered the land of Mesopotamia a garden of fertility, are now being repeated on an extensive scale under the same engineer who was responsible for the very successful irrigation works in the valley of the Nile. Our United States Consul at Bagdad, Turkey, speaking of the importance of these works, says that if the plan should succeed only in part, it promises to revolutionize commerce and shift trade balances and traffic in that part of the world. A total of 12,500,000 acres of land is to be reclaimed at an estimated cost of $18 per acre, and so fertile is the land when properly irrigated, that its estimated value, according to the Turkish government, will be $155 per acre, the soil being capable of yielding large crops of wheat, barley, and cotton.

We spoke of sentiment entering into the interest with which we regard this work, and there is certainly something that appeals strongly to the imagination in the fact that both in ancient Egypt and in even more ancient Mesopotamia, the Anglo-Saxon, after a lapse of four or five thousand years, should be repeating on a larger scale and with the greater skill rendered possible by modern appliances those feats of irrigation which are one of the chief glories of the ancient, but never-to-be-forgotten, races that once flourished in the valleys of the Nile and the Euphrates.

Whatever may be the future fate of the great Anglo-Saxon race, the vast works of irrigation which it has carried out in India and in Egypt and is now actively prosecuting in Mesopotamia, must ever stand out as one of the brightest evidences of its civilizing and uplifting activity.

During the recent progress of President Roosevelt down the valley of the Nile, his visit to the great reservoir at Assouan and the sight of the marvelous fertility with which it has enriched the valley below, must have carried his thought to those even greater works of irrigation which are now being prosecuted in the arid region of our Western States; works which owe their inception largely to his own tireless energy and enthusiasm. Here also the latest and most powerful branch of the great Anglo-Saxon race, in the space of a few years, has completed the initial work for a project which promises to bring thirty million acres of unproductive land under the richest cultivation. And in this connection it is timely to draw attention to the great ability with which the Reclamation Service has done and is now carrying on its work. A well-deserved tribute to the engineers in charge was recently made by Senator Newland of Nevada, in which he stated that the projects had been for the most part wisely selected and the work well done, such mistakes, none of them serious, as have been made being the result of the extraordinary pressure brought to bear upon the Reclamation Service by the political representatives of the regions affected. Said the Senator: "We have had one of the most capable and honest construction services organized that has ever existed in the history of this country. The Committee on Irrigation of the Senate has been engaged during the past year in visiting these various works, and not a whisper of corruption has reached them. It has been a work conducted with rare intelligence, with rare integrity, and with rare speed."

The work already accomplished consists in the provision of dams, headworks, etc., and the $30,000,000 now required is for the purpose of utilizing the water so stored, by the construction of canals for distributing the supply upon the millions of acres which only await its arrival to spring into instant fertility.

TESTS OF TUNGSTEN LAMPS

In a bulletin recently issued by the University of Illinois, T. H. Amrine and A. Guell present the results of an important study of various types of tungsten and incandescent lamps, a study which should prove of considerable interest in view of the growing importance of metallic filament illumination. The conclusions of their investigation may be thus summarized.

Comparisons of the durability of filaments made by the colloid, deposition, and paste processes are very difficult to make because the three types are usually mounted differently. Undoubtedly the manner of mounting the filament has a great effect upon its life, and whether the superior life of one type lamp is due to the fact that it has a better scheme of mounting or to the fact that the process of manufacturing is better, can hardly be decided definitely from these tests. Tests of filaments made by the three processes and mounted in exactly the same way would be necessary to decide the question definitely. From the tests described, however, the colloid process seems to give a filament that is less durable than the other two. The tests show that performances of tungsten lamps vary to a surprising degree, depending upon the kind of lamps used and upon the conditions under which they are burned. Some lamps will give as high an operating cost as the old carbon lamps while burning under certain conditions, whereas other lamps will give good results under those same conditions. Under the best conditions, however, the tungsten lamps now on the market give excellent results. Their efficiency is maintained in a remarkable way and the life is very long, often several times what the advertised life is. Breakages in shipment and handling have been reduced to a small fraction of what was formerly common. Of three hundred lamps purchased for the tests by the experimenters, only three were received with broken filaments; and although the lamps in some of the tests were handled dozens of times, almost no trouble was experienced so far as the breakage of filaments was concerned.

ENGINEERING.

The Minister of Public Works of Panama will shortly ask for bids for the construction of a railroad from Panama to David, a distance of 200 miles. Bids will be asked also for lines from David to Bocas del Toro, and from Panama to Los Santos.

The Navy Department recommends an appropriation of $10,000 for prizes, etc., to be awarded ships in commission for general efficiency and economy in coal consumption It is estimated by the Department that competitions of this character have resulted, and will continue to result, in a saving of ten per cent in coal consumption

In spite of the steady increase in passenger travel in this city, the opening of the new East River bridges is beginning to tell heavily upon the traffic over the East River ferries. The Union Ferry Company of Brooklyn has been obliged to discharge three boat crews, and change the schedule on three different lines from a 10-minute to a 20-minute headway

Acting on the recommendation of the Public Service Commission, the Interborough Company of this city will install cars with destination signs on the elevated lines, which will automatically tell the name of the station the train is approaching The great convenience of this arrangement to the traveling public will be out of all proportion to the small cost of putting it in place

The British Navy estimates for the present year call for five battleships of the dreadnought type, five protected cruisers of 25 knots or over, twenty destroyers, a number of submarines, and two floating docks In cluding the ships to be laid down this year, the dreadnoughts built or building for the three leading naval powers are for Great Britain, 27, Germany, 17, United States, 10

Speaking on the subject of defective open-hearth rails, at the last annual convention of the American Society for Testing Materials Robert Job emphasizes the fact that the mere term ' open hearth is in itself no guarantee that the rails made under that system will give good service, since they are subject to the same general defects of manufacture as Bessemer rails, and hence require equal care during rolling etc

The Pennsylvania Railroad recently ran its first Pullman train from Harrison, N J, by way of its new tunnel system to Long Island and return It will be three or four months, however, before the whole system is thrown open for public service The tunnels to Long Island, unless the plans of the company miscarry will be publicly opened on the 15th of May, and those to the westward under the Hudson River by about the 15th of July

The Army Board is making some important experiments to determine the resisting power of a solid mass of concrete, as compared with armor plate In a recent test with a 12-inch gun, a shot was fired which penetrated the concrete for a distance of 21 feet, which is equivalent to the piercing of a 19-inch armor plate The target is now being reconstructed for tests with the new 14-inch gun, which it is expected will give even better results.

The Director of the Royal Dockyard at Castellamare, Italy, has produced, if the reports are to be believed, a torpedo boat without funnels By means of electrical ventilators the products of combustion are discharged from the vessel without the assistance of smokestacks. The first experiments, on a trip from Castellamare to Naples, are said to have been ex tremely successful, no smoke being shown and the vessel getting up steam with great rapidity

The shortage or surplusage of freight cars is one of the reliable indications of business activity, if not of business prosperity The great surplus of cars which existed at the time of the panic in November, 1907, was gradually reduced until it was wiped out in the autumn of 1909 To-day, not only is there no surplus, but the indications are that during the coming season there will be a large shortage, due to the steadily increasing volume of business.

The Hudson and Manhattan Railroad Company has built two steel cars which are specially designed for transporting baggage between the steam railway terminals, which are served by the Hudson River tunnels. With a view to avoiding extra handling and trucking, each car is arranged to receive eight loaded baggage trucks, which are loaded and unloaded between platform and car over folding steel plate aprons, which form part of the permanent attachments of the car.

The Isthmian Canal Commission has called for the manufacture, delivery, and erection of about 58,000 tons of steel parts, which will be used in the construction of the forty-six mitering lock gates of two leaves each on the Panama Canal. These are the largest lock gates ever built. They are all about 65 feet wide, and vary from 47 feet 4 inches to 82 feet in height. Piled one above the other on end they would make a tower 1 1/4 miles in height. The contract will be worth about $5,000,000.

ELECTRICITY

At Harvard University a wireless telegraph club has been formed with a view to studying wireless telegraphy, and one of the special objects is to discover some method of overcoming amateur interference

Some time ago the United States Steel Corporation installed two Heroult furnaces, one at Worcester Mass, and the other at South Chicago These furnaces have been in constant service ever since, doing twelve heats per day It requires between an hour and an hour and a half to refine a metric ton of steel and 190 kilowatt hours are consumed to desulphurize and dephosphorize the metal The cost of repairs on the furnace has amounted to about six cents per ton of steel, and the electrodes are consumed at the rate of six pounds per ton.

A test of the telephone service in Wisconsin was recently made by a commission. The investigation was carried on secretly, so as to determine the actual conditions of service It was found that the average time between a call and a response was 4 78 seconds The quickest average response came in 3 17 seconds and the slowest in 7 3 seconds Those exchanges which most quickly responded to a call were found to be more efficient in every other respect as well, so that this single test provided a gage of the service offered by the exchanges

It is remarkable that while wireless telegraphy has made rapid strides very important considerations have been almost entirely neglected Much attention has been paid to attunement and selectivity and also to the refinement of instruments while the development of the antenna has been slow At the receiving station particularly not much has been done toward locating the antenna wires so as to intercept a maximum of wave energy Aside from Braun's fan shaped grid which marked an epoch very little along this line has been extensively adopted in practice

A telephone cable loaded with Pupin coils was laid in Lake Constance in 1906 This was a lead-covered cable and it was very difficult to lay it on account of its great weight Mr Dieselhorst, who laid the cable has been experimenting with loaded submarine telephone cables and has evolved a construction which is to be used across the English Channel to connect London with Paris The cable is covered with gutta percha and wire sheathing and the loading coils have been introduced so ingeniously as to increase the diameter of the cable from one inch to but three inches So gradually is the cable swelled at the loading points, that it can be paid out over a four foot sheave wheel The cable has been tested in salt water for fifteen months, and from time to time has been subjected to pressures of four tons per square inch

A series of tests has recently been made to determine the strength of the metallic filaments of lamps and their resistance to shock The lamps were tested by placing them at the bottom of an inclined plane, and rolling rubber balls filled with lead down the plane The shock was varied by starting the balls at different distances from the lamps It was found that with lamps of equal voltage the strength of the filament varied inversely as the candle-power and for lamps of equal candle-power the strength varied inversely as the voltage In some lamps it was found that certain parts were more sensitive to shock than the filaments. When the filaments were heated to a white heat they became too flexible to be broken by a shock, but the loops were distorted under repeated blows until they came in contact with each other

Sterilization of white wine is the object of a paper presented to the Académie des Sciences by Messrs. Maurain and Warcollier Previously they studied the action of ultra violet rays from a quartz mercury vapor lamp upon cider in fermentation With the same apparatus they made researches upon sparkling white wine and found how much time it took for the rays to act upon different thicknesses of layer so as to destroy the fermenting principle and thus prevent any new fermentation Using layers of wine of 1/4 millimeter (0 01 inch) held between a 0 2 inch quartz plate and a glass plate and exposed to the lamp so that this latter was 1 6 inches distant, they found that fermentation was stopped in all cases for an exposure of above 10 seconds and never for an exposure below 5 seconds. With 1 7 millimeters (0 07 inch) exposed at the same distance from the lamp fermentation was always stopped after an exposure of over 1 minute and never in less than 30 seconds. It is to be noted that in the case of pure cider, to sterilize it we need an exposure of over 2 or 3 minutes for the first mentioned thickness of layer, and sterilization is not reached even after 15 minutes exposure for a 0 04 inch layer Thus it will be seen that the sterilizing of white wine can be more easily carried out than that of cider, this being no doubt due to the fact that the wine is more transparent to ultra-violet rays.

SCIENCE.

Prof. Hilprecht's tablet, said to uphold the Biblical account of the Deluge, was discussed at a meeting of the American Oriental Society at the Johns Hopkins University Prof. G A. Barton of Bryn Mawr College, Prof Paul Haupt of Johns Hopkins University, and Prof Albert T Clay of Yale University, thought that Prof Hilprecht had been too imaginative in interpreting the fragmentary inscription It is asserted that the restoration made by Prof Hilprecht in filling in broken lines were conjectural emendations Prof Hilprecht's claim that the tablet was written some time between 2137 and 2005 B C is regarded as unfounded, it being stated that the tablet belongs to a much later period

The perfume and flavor of vanilla are due to a substance called vanillin, which also occurs as an ingredient of numerous resins Vanillin has been made synthetically by Tiemann and Maarmann from coniferin a glucoside which is found in various species of conifers The same chemists subsequently made the commercial synthesis of vanillin possible by substituting eugenol for coniferin The price of vanillin has fallen from $770 per pound in 1876 to $4 per pound in 1909 A further reduction is scarcely possible because of the high price of eugenol Hence chemists have been experimenting in another direction and Guyot and Gry have applied to the preparation of vanillin the general methods of synthesis of aromatic aldehydes, which were recently discovered by Guyot Their experiments are described in a recent number of the Bulletin de la Société d Encouragement

The price of pure Para India rubber, which in 1903 was 88 cents per pound, rose last year to $2 25 per pound This increase in price gives additional interest to the processes of regeneration of waste rubber and of the manufacture of substitutes The regeneration of vulcanized India rubber consists in removing the sulphur, which was added in the process of vulcanization The scrap rubber is assorted according to quality and is treated either with sulphuric acid or with potash, for the purpose of destroying fibers of cloth, etc and of removing the greater part of the sulphur The material is then ground and washed This regenerated India rubber is used only as an addition in small proportions to new rubber Artificial or imitation rubber is made by methods which resemble the process of vulcanizing natural India rubber, for example by treating linseed oil with sulphur or sulphur chloride

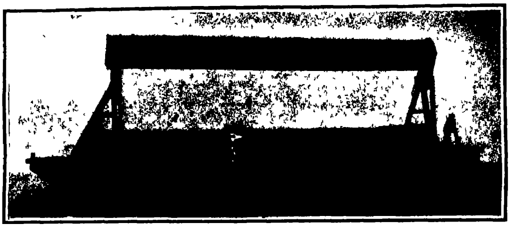
One of the most interesting results of the Smithsonian African Expedition has just been published by Mr Gerrit S Miller Jr curator of the Division of Mammals U S National Museum under the title of Description of a New Species of Hippopotamus. There have been for some years in the collections of the National Museum two skulls of hippopotami, one of which was from the Zambesi River East Africa and the other from Angola West Africa These skulls differed materially in several details of form chiefly however in the constricted shape of the rostrum but the characters were not deemed of sufficient value to justify the creation of a new species for the differences might have been due to individual variations The receipt of eight skulls from British East Africa collected by the Smithsonian African Expedition showed conclusively that the individual variations were so slight in the East African specimens that Mr Miller was led to believe that the two skulls represented two distinct species one from East Africa and one from West Africa A critical study of the skulls revealed other differences in their characters that were of sufficient importance to justify Mr Miller in making a new species of the West African specimen to which he gives the name *constrictus*

The gas bags of modern balloons are made of a cotton fabric coated with India rubber in the most careful manner, in order to assure perfect impermeability without sacrificing lightness For all large balloons, and especially for dirigibles two layers of cloth are superposed and cemented together The outer skin is covered with India rubber on one side only but the inner skin is coated on both sides In German balloons the inner canvas is cut straight and the outer canvas is cut bias In this construction gores with angles of 45 deg are used and the seams are covered which causes a slight increase in weight French balloon makers prefer to cut both canvases straight Experiments show that the tensile strength of the envelopes thus made is approximately equal in all directions Each method of construction has its advantages and its defects As India rubber, even when vulcanized, is altered by exposure to light, the canvas is colored yellow in order to arrest the violet and ultraviolet rays, which are the most active The pigment used in France is chromate of lead, which unfortunately must be applied to the canvas before it is coated with rubber, and which consequently prevents the vulcanization of the rubber, because the chromate of lead is blackened by heat. Picric acid is free from this objection, but its employment is too dangerous.

THE "VIKING"—SELF-DUMPING DECK SCOW.

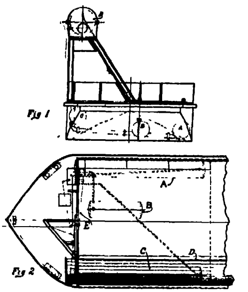
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

A novel system of self-dumping scow especially designed for the discharge of rock and solid débris has been devised by Mr. A. F. Viking, engineer and shipbuilder of Stockholm. At this port the economical dumping of such material into the water is of particular interest, inasmuch as the blasting of rock in



After dumping, the scow returns to an even keel.

connection with the extensions to the harbor or the streets of the city is in continuous progress. Several designs for automatic dumping have been evolved, but the "Viking" system, so called after its designer, has been the first to be submitted to practical test and has proved remarkably successful. Through the courtesy of the inventor we are enabled to illustrate and describe this new barge. It differs in its action from any

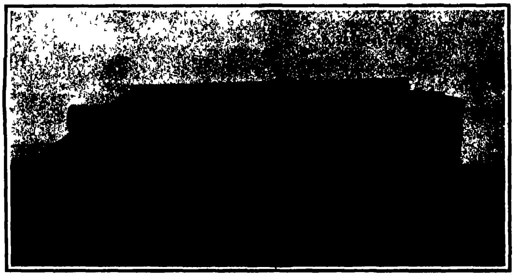


A, B, C, D are ballast tanks by the emptying and filling of which the scow is dumped and righted.

End elevation and half-deck plan of scow.

other vessels of this class in service, inasmuch as instead of the contents being dumped through self-opening doors in the bottom of the hull, the scow is tipped over on its beam ends by a very simple action. The load is carried on a flush deck, or the latter is fitted with low bulwarks. On one side, extending the full length of the scow, is an elevated cylindrical tank D, mounted about 16 feet above the level of the deck on two tripods. When it is desired to dump the barge, the equilibrium of the latter is upset merely by forcing water through the agency of compressed air into the elevated tank, which causes the scow to tilt over and shoot its load. Should the flush deck be fitted with low bulwarks, these are fashioned in the form of bottom hinged doors on the discharging side, so that they fall down as the barge heels over, and permit the load to be shot cleanly.

In the hold of the scow on the side opposite the elevated cylindrical tank is carried another tubular tank A about half the length of the former. This is filled with water, and in the case of the scow illustrated holds about six tons for a load of 200 tons on the deck. Alongside this water tank is a small cylindrical vessel B containing compressed air, the pressure being approximately seven atmospheres. On the same side as the elevated tank in the hold below, is a third cylinder C also about half the length of the elevated



The scow tilted and load sliding into the water.

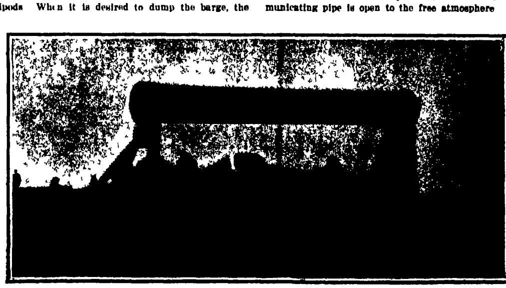
cylinder which at first is empty, but which is always open to the outer atmosphere through a small pipe.

The water vessel A in the body of the pontoon is in open communication by means of a pipe E with the elevated tank, and the former is also in connection by another pipe with a valve box placed at the foot of the tripod carrying the upper tank. When the valve in this box is in its initial position, this second communicating pipe is open to the free atmosphere. The compressed-air vessel is also connected to this valve box, but is shut off from the same until ready for dumping. The third vessel below the elevated cylinder, as already mentioned, is always open to the free atmosphere through a pipe, but there is a second pipe and valve provided in connection with the main communicating pipe between the first water tank and the elevated cylinder. It will thus be seen that there is always open communication between the first water tank and the elevated cylinder by means of a main pipe which is carried up alongside the vertical leg of the tripod at one end. In addition there is a smaller air pipe running up one of the triangular legs and passing right into the body of the tank, having its outlet near the top of the cylinder inside. This pipe is in connection with the outer atmosphere, so that normally the upper vessel is full of air.

The load is stowed on deck in the manner shown in the illustration. When rock is handled, bulwarks on three sides only are necessary, the fourth side from which dumping is effected, below the elevated tank, being left quite open or at the most having only a low ridge. If soft material is carried, hinged doors, as already described, may be used, these automatically opening under the pressure from the load on deck when the scow is inclined in the dumping operation, and falling flat and clear so as not to obstruct the shoot.

When the loaded barge has been towed to the dumping site, a cord is pulled connecting the mechanism of the scow with the tug. This opens a valve, which permits the compressed air to flow to the valve box, and also a slide valve in the latter, whereby the compressed air is admitted into the lower water vessel A. The pressure exerted forces the water from the lower tank into the elevated cylinder D, the displaced air in the latter escaping, and, as the upper tank becomes charged, the barge loses its equilibrium, heels over on the elevated tank side, and the load slips off the inclined deck into the water. When the load is shot the control cord is again pulled, the slide valve in the valve box is returned to its normal position, cutting off the supply of compressed air to the lower water tank, and at the same time opening the latter to the free air.

The load may slip off the deck at varying inclinations, this factor depending on the friction between the load and the deck and the character of the débris. If the slipping takes place early, at a low deck inclination, the upper cylinder may never reach the water, for the scow rights itself immediately the load is discharged. Should such result, the water forced into the elevated tank returns to the lower water tank directly the compressed-air supply to the latter is cut off by the second pull of the cord controlling the mechanism. It may happen, however, that the scow heels right over, and the upper tank is brought into the water, the barge thus floating in an inclined position. To bring it back to the upright position a third pull is given to the control rope, which at once opens the communication between the upper tank D and the water vessel C placed immediately below it in the hold. As this latter tank is always placed in a position lower than the elevated cylinder, the water must flow by gravitation into it. When a sufficient quantity of water has passed from the upper to the lower cylinder, the barge rights itself, and the water remaining in the elevated tank as well as that in the tank immediately below, returns to the main water cylinder on the opposite side of the vessel in the hold, by gravitation. This accomplished, a fourth pull on the control cord returns all parts to their original positions. The compressed air is fed into its vessel by means of a hose coupled to a valve in the top of the air chest, and when sufficiently charged the valve is closed and the hose removed. When the barge is in its upright position, all water in



Loaded and ready for dumping.

THE "VIKING"—A SELF-DUMPING DECK SCOW.

the elevated tank, or the one immediately below it, must return to the first tank on the opposite side of the barge, as this latter is placed at the lowest point, the return being purely gravitational It will also be seen that the water circulating between the tanks cannot escape. Glycerine is mixed with the water to prevent freezing in cold weather, so that the system can be used any time of the year irrespective of climatic conditions.

The scow shown in the accompanying illustrations is in daily service at Stockholm, and has proved eminently satisfactory to the engineers of the city The results that have been obtained prove that this self dumping barge is superior to the ordinary hopper type with false bottoms. It is cheaper in first cost and maintenance, can handle rock of practically any size and weight within its total capacity, and is a first class craft for any harbor transport. If desired, the elevated cylinder can be unshipped in a couple of hours and the barge used as an ordinary lighter The system is applicable to any type of barge whether of the blunt-ended type or one of fine lines It is only necessary to insure a sufficient breadth to counteract the influence from high winds The success of the flush-deck type has induced the inventor to extend the idea to craft with sunken holds for handling gravel, mud, and other semi liquid or soft material, which cannot be accommodated on a flush deck.

HALLEY'S COMET AT ITS BRIGHTEST

BY HENRY NORRIS RUSSELL, PH D, PROFESSOR OF ASTRONOMY AT PRINCETON UNIVERSITY

It may have seemed remarkable to many people that so long a time has elapsed since the first observation of Halley's comet at its present return, and yet it has not shown itself at all to ordinary eyes. The accompanying illustration (Fig 1) will help to explain this. When first detected last September with very powerful telescopic aid it was far beyond the limits of our diagram, at twice the distance of Mars from the sun, and nearly as remote from the earth At first the two

Fig 4 Spectrum of Halley's comet

Photographed at the Yerkes Observatory by Prof Frost, January 14th 1910 The spectrum of the comet is in the middle between the two brightest star-spectra. See description in text. The blue end of the spectrum is on the right, the ultra-violet on the left.

bodies approached each other rapidly, but before the end of the year our planet crossed the line joining the comet with the sun, and by January 1st, as the figure shows, we were moving almost straight away from it During the early part of the year the earth and comet passed on opposite sides of the sun, so that it was lost to our view early in March

About the time that this is printed it will come into sight again, on the other side of the sun rising before daybreak But now its path has curved so that it is coming toward us—almost directly, if we take our motion into account as well as its own It therefore seems to stand almost still among the stars, while growing steadily larger and brighter, so that any one might tell by its mere changes in appearance that it was approaching us rapidly

Finally, about the middle of May the comet will apparently approach the sun again, and on the 18th it will pass in front of him, literally between us and the sun, transiting the latter's disk If at this time its tail is more than fifteen million miles in length we will pass through it, as the figure shows.*

The comet's closest approach to us comes two days later, on May 20th, when it is but fourteen million miles away For a few days following this it will be splendidly visible in the evening sky, and then it will fade gradually as it recedes from us.

It is clear from the diagram that this apparition of the comet is an exceptionally favorable one, for it passes the earth almost at the point where their orbits come nearest to one another If it had returned only three weeks earlier, it would have come as near as possible—only seven millions of miles—but at this time it would have been directly south of the earth, astronomically speaking, almost over our south pole, and quite invisible from northern latitudes. It therefore appears that the present conditions are almost ideally favorable for observers placed as we are, north of the equator

The illustration on the first page shows better than any verbal description where to look for the comet in the morning sky in New York The moon and Venus

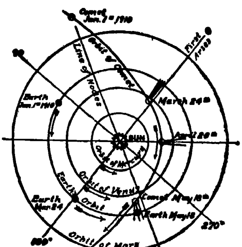


Fig 1 —RELATIVE POSITIONS OF HALLEY'S COMET, THE EARTH, AND THE SUN

are shown in the positions which they will occupy about May 1st, when, on the whole, the comet can be seen to the best advantage At an earlier date, Venus was higher in the sky, compared with the comet. There was less trouble then from moonlight, but the comet did not rise so early—about 4 A M on April 15th as against 3 A M, on the later date

The comet's brightness when it appears in the evening sky about May 20th will be sufficient to render any finding diagram unnecessary It will only be needful to look toward the west half an hour or more before the comet sets which it does at 8 20 P M on the 20th 9 15 on the 21st, and 9 55 on the 22nd, after which it will be clearly visible until after 10 P M

Our other illustrations which appear here through the courtesy of Profs Frost and Barnard of the Yerkes Observatory show the appearance and character of the comet earlier in its apparition Fig 2 illustrates its extreme faintness at the time of its rediscovery (which was announced by Prof Wolf of Heidelberg less than a week before the earliest of the four photographs here shown was taken) while it was still 300 million miles distant, both from the earth and from the sun On any one plate it is difficult, if not impossible to distinguish the comet from the multitude of faint stars around it, but on comparing the four (which show exactly the same region of the sky) it is easy to see that the stars are the same in all, while the comet is 'here to-day and gone to-morrow"

With the great Yerkes telescope (which gives far smaller and sharper images of the stars than can be reproduced on any known photographic plate) the comet was even at this time quite different from the stars in appearance, in Prof Barnard's words, "a fleck of light surrounded by a faint nebulosity" with no

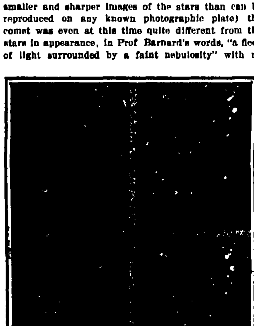


Fig. 2.—Halley's comet at its reappearance in 1909.

From photographs taken by Mr Lee with the two-foot reflector of the Yerkes Observatory These four photographs represent the same portion of the sky. The arrows point to the comet which appears like a faint star but moves from night to night.

definite boundary His measures, made on several nights, show that its actual diameter was about 12,500 miles.

Our second illustration, from a photograph taken when the comet was 143 million miles from the sun, and 163 million from us, shows it already well advanced in the changes which invariably accompany the approach of any considerable comet to its perihelion The head of the comet has become larger—not merely in apparent size, owing to its approach to us but actually in miles, while a faint slender tail, pointed away from the sun, makes its appearance

As Fig. 1 shows, the tail, which extends directly away from the sun, was at this time also nearly in line behind the head as seen from the earth so that its actual length must have been much greater than it appears to be—about five million miles, according to Prof Barnard

This considerable development of the tail, while the comet was still at two and one-half times its least distance from the sun, makes it probable that at and after the perihelion passage, on April 20th it will be much longer, probably long enough to envelop the earth as it sweeps past.

Our third illustration shows the spectrum of the comet photographed on January 14th, when it was about 170 million miles from the sun

In taking such a photograph, a prism is placed in front of the camera. The light of a star is thus drawn out into a line which, by letting it trail on the plate is broadened into a band, crossed by the dark lines which tell us what absorbing gases exist in the star's atmosphere Most of the objects on the plate are the spectra of stars near the comet obtained in this way The comet's spectrum is near the middle between the two very broad and conspicuous 'comparison spectra, which were produced by supplementary exposures on some bright star, and serve as reference marks to find the position of the lines in the spectrum of the comet itself The latter unlike that of the stars consists

Fig. 3.—Halley's comet on February 3rd, 1910.

From a photograph taken at the Yerkes Observatory by Prof Barnard. As the instrument was kept pointed at the comet during the exposure the stars appear as short streaks. The actual length of the comet's tail is about five million miles

mainly of bright bands or lines three of which are conspicuous The brightest of these as is shown by comparison with the hydrogen lines of the comparison spectrum is the so-called cyanogen band at the extreme violet end of the visual spectrum The others are probably as in the case of other comets, also due to gaseous compounds of carbon

Between these bright bands can be seen a faint continuous spectrum, due to reflected sunlight

When the comet first appeared the photographs made at the Lick Observatory showed this continuous spectrum alone At that time it must have been shining entirely by reflected light, but by the date of our illustration it had already begun to be self luminous This is corroborated by the fact that its brightness increased much more rapidly than could be explained by the mere increase in the amount of reflected light, due to its approach to the sun and to us

This intrinsic light of the comet, as its spectrum shows, is given off by luminous gas, but we do not yet know what makes this gas shine It can hardly be high temperature, for the comet had just come from the depths of interplanetary space, and did not yet receive nearly as much heat from the sun as the earth does. It must however, be due to some kind of solar action, for it increases very rapidly as a comet approaches the sun We can reproduce the same spectrum in the laboratory by passing an electrical discharge through a vacuum tube containing compounds of carbon and nitrogen at very low pressure

It is of special interest that, even if the carbon compounds form but a small percentage of the gas in the tube, their spectrum becomes relatively prominent when the pressure is made very small say 1/100 000 of that of ordinary air It may be, therefore, that at the lowest pressures carbon compounds have an exceptional capacity for shining, and it would be unsafe to conclude that they are the principal gaseous con-

* Prof. Barnard has informed us that the tail was 14,000,000 miles long on February 27th, from which it may well be inferred that it is much longer than 15,000,000 miles now.—Ed.

stituents of the comet, because they give off almost all the light

It may be added that the cyanogen bands in the spectrum are produced not only by the poisonous gas of that name but in all cases when carbon and nitrogen are together under electrical excitement For example they are very strong in the spectrum of an ordinary arc light where the nitrogen comes from the arc and the carbon from the terminals It would be about as reasonable to conclude that an arc light was poisonous after looking at it through a spectroscope from a distance, as to make the same deduction about a comet

Whatever may be the origin of this intrinsic light of comets it is responsible for most of the phenomena which make them of general interest for almost all the light of the tail as well as of the head of a bright comet is of this kind If Halley's comet shone by reflected sunlight alone it would be barely visible to the naked eye, even under the most favorable circumstances.

Actually owing to its intrinsic light it has been a conspicuous object at every return for the last 2,000 years The only gap in the record—in A D 912—has lately been filled by the discovery of unmistakable references in old Japanese chronicles.

The actual quantity of matter composing it must however be very small as compared with the more familiar heavenly bodies It is possible to form a rough guess as to its amount by considering the amount of light which it reflects when it is not shining on its own account From the estimates of magnitude made last September, it appears that a single body only a little over 30 miles in diameter at the distance of the comet would have sent us as much reflected light provided that its reflecting power was equal to that of the moon, which is lower than that of most of the planets

It is, therefore clear that the comet must be composed of separate particles widely separated The whole cross-section of the comet (12,600 miles in diameter) is about 120 million square miles, while the total area of all the reflecting particles, according to the above estimate is about 1 000 square miles A ray of sunlight falling on it has therefore less than one chance in 100,000 of being stopped, and all the rest of getting through some empty space It is no wonder that comets are transparent, and that stars can be seen through them! If we only knew how big these particles were, we could now estimate their number and their total mass But here we are quite in the dark As the light of the comet seems uniformly diffused and it shows no signs of resolution into points of light, the number of particles composing it must at least be counted by thousands Their average diameter must therefore be less than a mile, though they may vary enormously in size If all gathered into one compact group they could at most hardly exceed in bulk the satellites of Mars or the smallest of the asteroids

But how much smaller than this limit their actual dimensions may be we do not know If, purely for illustration, we suppose that they average an inch across, there would be some five or six million millions of them This sounds like an enormous number, but if we calculate the bulk of the comet we find that there would be only five or six particles per cubic mile of space on the average inside it Near the center they would doubtless be more closely packed, and more thinly toward the outer parts of the comet. The combined bulk of all these particles would be about 80 million cubic yards a large amount from the engineering standpoint but not equal to the quantity of water which falls within the limits of the smallest State in the Union during a heavy rainstorm

This may serve to give us some idea of the extreme tenuity of the comet as a whole If we took a space as big as the comet, that is, half as much again in diameter as the earth, and sowed ordinary golf balls through it at the rate of two or three per cubic mile, leaving the intervening space absolutely vacant we would get something that would look quite as bright as Halley's comet - if put alongside it when it first appeared

The gaseous matter which gives most of the light at perihelion probably oozes out of the solid particles as these grow warm under the sun's heat when they approach it As the gas becomes luminous under solar action, the brightness of the comet increases and its outer regions originally invisible because the number of reflecting particles was too small to influence our eyes, gradually come into view

Some of this is repelled from the head of the comet, by little known forces, and driven away from the sun by the action of the sunlight which, as is well known, exerts a force of repulsion which, if a particle is exceedingly small as are the gaseous molecules, is stronger than the attraction of the sun

Thus arises the long and magnificent tail which, like the smoke-trail of a steamer at sea is ever being renewed at one end and fading away at the other, even though it seems to accompany the comet in its journey

As the comet recedes from the sun, much of this gaseous matter has thus been lost, never to be regained Some of the remainder probably condenses round the solid particles when they become cold, and some escapes into space

The comet is thus gradually losing its substance, and in the course of ages it may be deprived of all its tail forming material, and lose its former glory This seems to have actually happened to some of the short period comets, one at least of which has disappeared altogether

Halley's comet is perhaps preserved from such a fate by the longer interval between its returns to the region near the sun, where its activity takes place It may be, too, that it has more of the right sort of material to spare for a tail But the time may come when most of this is lost, and its successive appearances may gradually lose those impressive features which have so long inspired awe and wonder in the hearts of mankind, and dwindle at last into something which the professional astronomer alone will be interested in watching

The Mercury Vapor Lamp and Its Effect on the Eye.

About a year ago we published a reference to a report of Prof J Norman Collie, F R S, stating in effect that a German medical journal had described certain cases of alleged injury inflicted upon the eyes by rays of mercury vapor lamps These cases referred to all prove to have resulted not from the mercury vapor illuminating lamp, which is now so largely in use in this country and which is constructed with a tube or container of glass, but from a special lamp used in medical, sterilization, and chemical processes, having a quartz container The medical or sterilizing lamp, to be sure, uses mercury vapor, but its container being of quartz, it is transparent to those rays which may be injurious to the eyes, while glass is opaque to such rays and does not permit their passage The quartz lamps referred to by Prof Collie are intentionally made to omit germ-destroying rays Dr Charles P Steinmetz who has made a careful study of mercury vapor lamps used for illuminating purposes, stated in an article in the Electrical World and Engineer of February 21st, 1903, as follows

"The mercury arc therefore is the only known artificial illuminant which is perfectly harmless and thus especially suited for use where accurate work has to be done by artificial illumination, as in drawing rooms, offices, factories, etc"

The same scientist in an article in the Daily Union, Schenectady N Y, on January 17th, 1903, stated as follows

"Therefore electric lights are less harmful than gas or oil lamps, being whiter, and the white daylight the least harmful while the mercury arc light which is entirely devoid of red rays, is absolutely harmless, and a person can look straight into one of these mercury arcs of enormous brilliancy without being blinded by it"

In one of Dr Steinmetz's books entitled "Radiation, Light, and Illumination" he makes the following statement

"The harmful effect of working very much under artificial illumination is largely due to its energy effect, incident to a large amount of orange, red, and especially ultra red in the radiation of incandescent bodies used for illuminants and thus does not exist with 'cold light, as the light of the mercury lamp"

The Current Supplement.

Prof R F Ruttan writes most interestingly in current SUPPLEMENT No 1789 on the manufacture of alcohol from sawdust and other wood waste. A novel type of automatic stamp-vending machine is described and illustrated Prof Charles Edward Lucke writes on the development of power systems. Prof Otto N Witt's paper on fast and fugitive dyes is concluded Harlan I Smith presents some curious information on the wooden monuments of the Northwest Coast Indians A biography of the famous Dmitri Ivanovitsch Mendeléeff is published A method of instantaneous microphotography is described

Official Meteorological Summary, New York, N. Y., March, 1910.

Atmospheric pressure Highest, 30 51, lowest, 29 47, mean, 30 8. Temperature Highest, 78, date, 29th and 30th, lowest, 24, date, 18th, mean of warmest day, 64 5, date, 25th, coolest day, 32, date, 15th; mean of maximum for the month, 52.4, mean of minimum, 37 0, absolute mean, 44 7, normal, 37 5, daily excess compared with the mean of 40 years, 7 2. Warmest mean temperature of March, 48, in 1903; coldest mean, 29, in 1872 Absolute maximum and minimum of March for 40 years, 78 and 3. Average daily excess since January 1st, 3 5. Precipitation 0 86, greatest in 24 hours, 0 26; date, 1st and 2nd; average for March for 40 years, 4 10 Deficiency of this month compared with normal, 3 24 Accumulated deficiency since January 1st, 1.09 Greatest precipitation, 7.90, in 1876, least, 0.86 in 1910 Wind Prevailing direction, northwest; total movement, 7,922 miles; average hourly velocity, 10.7; maximum velocity, 44 miles per hour Weather. Clear days, 13; partly cloudy, 13; cloudy, 5, on which 0.01 or more of precipitation occurred, 6 Snowfall, 0 4 Mean relative humidity, 68.3. Dense fog, 2nd, 3rd. Sunshine, 69 2

The Highest Dam.

At the hour of two in the morning of Sunday, January 16th, the completion of the Shoshone dam in Wyoming was announced. This is the highest dam in the world, being 328 4 feet from the base to the parapet. It is located in the profound canyon of the Shoshone River, in one of the wildest and most picturesque regions of northern Wyoming The walls of the gorge are nearly perpendicular, and rise nearly 2,000 feet above the stream At its base the dam is 70 feet across; on top it is 175 feet in length, and at the base the dam is 108 feet wide

The completion of this dam creates an enormous reservoir, having a surface area of ten square miles and an average depth of seventy feet The capacity of this irrigation basin in gallons is something like 148,588,512,000 The construction of this great dam was attended with difficulty from the beginning, owing partly to the inaccessible section in which it stands.

The dam is to control for all time the great floods of the Shoshone River and to provide an ample water supply for the irrigation of more than 100,000 acres of exceptionally fertile land in the valley below, a portion of which is now available for settlers under the terms of the reclamation act.

The contract for the Shoshone dam was let September 18th, 1905, to a Chicago firm for $515,730 This firm, however defaulted, and the work was completed by another contractor

Rail-Cleaning Car.

When streets are cleaned by sweepers, whose brushes push the dirt before them, the dirt is swept into the grooves of the street railroad rails and then compacted by the wheels of the running cars The rails so coated with dirt offer a greater resistance to the electric current, thereby causing a greater amount of power to be used for the propelling of the cars. The rails must be constantly cleaned to avoid loss of current.

The Hanover Street Railway Company has built for this purpose a special rail-cleaning car It is similar in construction to a regular two-axle car, and has two 25-horse-power motors Between the front and rear wheels on both sides of the car are steel brushes, which loosen the dirt from the rails This dirt is automatically removed by a vacuum pump, and deposited in a box built into the lower part of the car between the axles of the driving wheels The vacuum pump is operated by an electric motor attached to the dirt box. To avoid the raising of dust in dry weather, a sprinkler and two tanks, holding about 925 gallons of water each, are provided

As soon as the box is filled, an automatic alarm notifies the motorman who shuts off the pump, raises the brushes, and takes the car to a place where it can be emptied and made ready for another trip

This car can be run at any rate of speed allowable in street traffic up to 17½ miles per hour, and still will work with good results It can be run by one man and the amount of power used at a speed of 10 miles per hour is only about 3,000 volts per mile. The car can clean daily an average of 45 miles of track, using according to weather conditions, up to 132 gallons of water and taking up to one cubic yard of dirt per mile of track

Death of Thomas A. Baxendale.

The founder of the box toe industry in this country, Mr Thomas A Baxendale, died at Brockton, Mass., on April 1st at the age of seventy A native of England, Mr Baxendale came to Brockton in 1867 a poor man. The shoe industry was then in its infancy He entered one of the large factories and invented the box toe which is now used in nine-tenths of the shoes that are worn Later, with John Simmons as a partner, he founded the firm of T A. Baxendale & Company He invented many machines for producing shoes, most of which are now in common use. He died a wealthy man

Death of Thomas B. Jeffery.

Mr Thomas B Jeffery, who invented what is known as the clincher pneumatic tire, died on April 3rd, at Pompeii, Italy He was for more than twenty-five years a partner of the firm of Gormully & Jeffery, makers of bicycles. English by birth, he came to this country at the age of eighteen, and settled in Chicago. He took an active interest not only in the development of the bicycle, but in the automobile as well.

Death of Paul Theodore Sievert.

Paul Theodore Sievert died January 11th, 1910, in Dresden. He was a well-known German manufacturer and inventor He is best known for an invention in which he applied compressed air for blowing vessels of glass of any desired size.

Correspondence.

WANTED—A RICE HULLING MACHINE

To the Editor of the SCIENTIFIC AMERICAN:

Whoever will invent a machine to hull rice, will be as great a benefactor to the rice farmer and the consumer as Eli Whitney in the invention of the cotton gin. The farmer often gets 75 cents per hundred or less for his raw product, and generally has his crop in the mill for months before he gets this. The mills are huge structures because of the necessity for large storage, but the real mill part of the plant is about the same in machinery as a flour mill. The main processes are two, the removal of the hull and the removal of the polish. The former is accomplished by burr stones, but the grain passing from under these is not completely clear of the hull. The next process is accomplished by a cylinder of wire cloth containing a revolving core of sheepskin with the wool on, which takes off the remaining hull and the outside of the grain as well. The native French of Louisiana prepare their rice by means of a wooden pestle, which removes the hulls and leaves the polish, the most nutritious part of the grain. Usually the mills have an arrangement for coating each grain with paraffin, but this is not even an improvement except in appearance.

Whoever will invent a small machine, say in size similar to a farmer's fan mill, that will remove the hull from the grain, will remove the rice crop from the enormous toll now paid the miller, and give a cheap and healthy food to the people as a superior substitute for the present rapidly ascending foodstuffs to which we have been accustomed. There are large investments in the milling of the crop but it ought to be a paying investment with $9.75 profit between the planter and the consumer on each 75 cents received by the farmer. C. W. CAMPBELL.

Johnston City, Ill.

THE EFFECT OF REFRACTION ON THE TRIANGULATION OF MOUNTAIN SUMMITS

A REPLY TO MISS PECK'S STATEMENTS IN THE PRESS

To the Editor of the SCIENTIFIC AMERICAN:

Since the announcement by Mrs. F. Bullock Workman of the results of the recent scientific and carefully executed measurement of the two summits of Mount Huascaran by the professional engineers sent out to Peru by her from Paris, Miss A. Peck has favored the press with communications, the evident purpose of which is to bolster up her assertions not based on any measurement data as to the height of that mountain by attempting to discredit the figures obtained by triangulation the most accurate method of measuring altitude known. To effect this the communications contain a quotation and two statements, one of the latter absurd and self-contradictory in its terms, so brought together as to tend to befog the mind of the reader and lead him to infer that in general the results of triangulation of a mountain summit by an expert engineer are likely to be vitiated to an extent of 4,000 feet by refraction.

The quotation from Mr. Mumm and the statement attributed to Dr. Collie, the one a publisher and the other a chemist by profession, neither of whom, so far as I know, has ever claimed to be an expert in altitude measurements, merely repeat in general terms what is well known to engineers that no method of determining the exact amount of refraction having been yet discovered, the present heights of certain high mountains obtained by triangulation may be somewhat changed, either higher or lower, should such method be discovered in the future. Such change would probably not be great in any case, and in many cases would be very slight, varying from nothing to a few feet, for no coefficient of refraction that is likely to be used would greatly alter the results now obtained.

Between the recognition of the fact that figures obtained by triangulation may not now be absolutely, though they are essentially, accurate, and the ridiculous statement asserted by Miss Peck to have been made by a nameless friend of a so-called 'former member of the British Royal Engineers' that he triangulated the great peak K-2 and obtained a height 4,000 feet greater than that now assigned to it by the Indian Survey, which impossible difference Miss Peck would have the public believe is due to refraction, there is an impassable gulf.

The possible discovery of an absolutely accurate method of determining refraction would affect chiefly the present altitudes assigned to certain very high Himalayan peaks, such as Mount Everest, which were triangulated from very distant points low down in the Indian plain, and to a less degree some other high peaks also measured from distant stations. At the discussion of a paper on mountain exploration read by me before the Royal Geographical Society in London in November, 1907, Sir Thomas Holdich, one of the most eminent living English engineers, for many years the head of the Survey of India engaged in Himalayan surveying, speaking of the very highest mountains said: "We do not know exactly, and at present there is no means of determining, what the exact effect of refraction may be in those altitudes, . . . and the result of variation when applied as correction to those observed trigonometrical altitudes may be considerable." To show what he judges to be considerable may be added his further remark, "Mount Everest will probably prove to be some hundred feet or so higher than we at present reckon it."

Observe that Sir Thomas considers one hundred feet in 29,002 the present height assigned to Mount Everest, a considerable change in the altitude of that peak which is the most extreme case of all on account of its great altitude, its distance from the measuring stations, and the large amount of moisture in the air above the hot, steamy plain of Bengal. He does not for a moment entertain the figure of 4,000 feet said to be suggested by the friend of the British Royal Engineer. If Sir Thomas's estimate be a probable one in this case, in the more favorable ones of lower summits measured from near stations the amount of correction would shade down nearly or quite to zero.

Now Miss Peck supposes an allowance similar to the friend of the Royal Engineer's 4,000 feet made to the ascertained height of Huascaran and asserts, "It might easily happen that the mountain is one or two thousand feet higher than it has been figured," which would bring it up well toward the altitude she has estimated it at. Such a supposition is not tenable. Even if the 4,000-foot statement regarding K 2 were true the conditions in this case are entirely different. Her plan is ingenious but not creditable to her knowledge of the principles of altitude-measurement. Suppositions have no place in this field. Observed facts are what count.

M. de Larminat and his assistants who are expert engineers and know what they are about triangulated the two summits of Huascaran from four accurately measured stations at an altitude of 12,500 feet, in the *immediate neighborhood of that mountain* in perfectly clear weather. Here was no immense distance, no haze in the air no great height of the summits above his stations, as in the case of the great Himalayan peaks mentioned, to cause any appreciable chance of error due to refraction. Refraction in this case, if not allowed for at all would be practically a negligible quantity. His results determined from four stations three being usually considered sufficient to insure accuracy, must be exact to within a very small figure. Prof. Fr. Schrader and M. Henri Vallot of Paris after a careful personal examination and checking of all M. de Larminat's observations and calculations have indorsed them as correct. The indorsement of engineers of such worldwide reputation as they have is a sufficient guarantee of the accuracy of the work. Miss Peck may therefore rest assured that this triangulation will be accepted by engineers and experts as accurate and definitely settling the question of the altitude of the two summits of Huascaran.

Miss Peck makes two other statements, the relation of which to the altitude of Huascaran is not apparent: (1) That I "improperly claimed" a world record with 23,394 feet, and (2) that Mr. Graham's ascent of 'Mount Kabru, about 24,000 feet, twenty years earlier, is now quite generally acknowledged." Mr. Graham on his return from the Eastern Himalaya claimed to have nearly ascended Mount Kabru as well as to have made a number of other high ascents. He gave an account of his experiences, in London. His claims were very generally disbelieved at the time and afterward by mountaineers and engineers, and were especially disputed by the Indian Survey, the members of which were in a particularly advantageous position to judge of their truth. The grounds for discrediting his ascent of Kabru were several but the strongest of all, well known to the Survey officials, has never, I think, been published as the Survey did not enter the lists in print against Mr. Graham. Within two years I have had the opportunity of discussing the question with a retired surveyor general of the Indian Survey, who was in Calcutta when Mr. Graham returned from his attempt on Kabru, and he expressed his disbelief in the strongest terms.

Some time after the event Mr. Douglass Freshfield advocated Mr. Graham's claim bringing forward no new evidence beyond Mr. Graham's original account, but basing his opinion on certain considerations of probability, which though specious were not conclusive and did not convince the public. He stood nearly alone for years. Recently a few of his friends have expressed their concurrence in his opinion, and in the United States Mr. E. S. Balch and Miss Peck have echoed the cry, though neither of them can have any knowledge of the question that can make their opinion regarding it of any value. The world at large has remained either neutral or disbelieving.

It is noteworthy that Mr. Graham had no instruments, not even an aneroid, with him by which to determine the altitudes he claimed to have reached so that, as in Miss Peck's case his ideas as to his altitudes were based wholly on guesswork. It is also significant, as an English journal recently stated, that after his account given in London, he never joined in the discussion that followed nor attempted by any further statement to defend his claim. Not long afterward he disappeared, and, so far as I have been able to learn, his whereabouts have since remained unknown.

Mr. Graham's account constitutes the only evidence available in the question. If anyone after reading this chooses to believe that his claim to have ascended Kabru is valid, he has a perfect right to do so, but such belief does not afford any proof of validity, nor does it warrant the person holding it in asserting that Mr. Graham's ascent "is now quite generally acknowledged." The only verdict that can be reached, as the matter stands is that of unproven.

In stating the above facts I wish it distinctly understood that I am not expressing my own opinion as to Mr. Graham's claim. This I have nowhere done either in lectures or in writing although such expression has been ascribed to me by others.

With regard to Miss Peck's repeated assertion that I 'improperly claimed' a world record with 23,394 feet, my position may be stated as follows. Although, as a matter of fact, this altitude attained by me in 1903, was and remained for several years the highest measured altitude reached on an ascent, and although I had every right to publish it to the world as a record, with two exceptions I have never mentioned it as such either in public or in print not even in the volume 'Ice Bound Heights of the Mustagh," by Mrs. Bullock Workman and myself in which I have described my ascent to that altitude. One exception was a mention of it in one of the issues of 'Who's Who'. The other was in connection with a paper on that ascent read before the Alpine Club in London in May, 1905, when I said:

'The word 'record' in the title of this paper is used as referring to the highest substantiated ascent yet made in mountaineering. The contention that Mr. Graham reached an *altitude of 24,000 feet has on* various grounds whether rightly or wrongly been so strongly disputed that it must be regarded as far from proved and therefore the altitude mentioned cannot properly claim a place among those acknowledged to have been made."

In this year 1910, so far as Mr. Graham's claim is concerned I see no reason to alter a word of that statement.

In view of the above I do not think it would be courteous in me to deprive Miss Peck of the distinction of 'improperly claiming' a world record in which she herself has enjoyed a monopoly for the last two years. During that time her chief appeal to the interest of the public has been not by scientific observations on natural phenomena at high altitudes but by constant reiteration in the press without the authority of any measurement proof of claims to the attainment of an altitude variously stated at from 25,000 to 23,000 feet which finally crystallized into 'It may be regarded as certain that Huascaran is above 23,000 feet.'

If, as seems probable the height is 24,000 feet I have the honor of breaking the world's record for men as well as women.

Mrs. Bullock Workman's engineers have now stripped her claim of all its and probabilities and brought it definitely down to 21,812 feet the altitude of the lower summit of Huascaran she claims to have ascended. WILLIAM HUNTER WORKMAN.

Algiers.

Effect of Rainfall on the Cotton Industry.

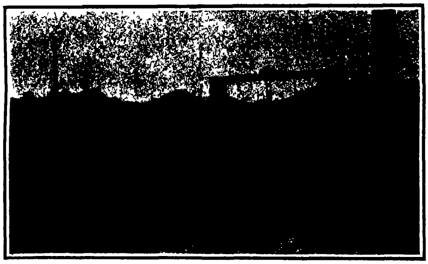
The amount of rainfall and the development of the cotton industry in any region are intimately connected. The first proof of this rather surprising assertion is found in the continual endeavor of inventors to devise means of giving to the air of cotton spinning rooms a proper and sufficient degree of humidity. But a deficiency of natural humidity cannot be perfectly remedied by artificial means, and it is a fact well known to all cotton spinners that the product of the spindles is considerably increased by the constant presence of a large amount of moisture in the air. The moist climate of Normandy has made that province the chief seat of the cotton industry in France, and for a similar reason Manchester has become the center of the English cotton manufacture. In addition to a moist atmosphere the cotton industry requires abundance of water in its visible form. Cotton mills are always located on or near streams and are provided with capacious reservoirs.

Hence the great diminution in the rainfall of the Manchester district which has taken place within the last half century is a valid cause for alarm. Hesketh has collated the records of rainfall made between 1860 and 1908. He finds that the mean annual rainfall was 36 inches between 1860 and 1886 but only 27 1-3 inches between 1886 and 1908. The observed shifting of one of the branches of the Gulf Stream is suggested as a possible cause of this great decrease in rainfall which threatens the industrial prosperity of Manchester and the surrounding district.—Cosmos.

THE DISINFECTION OF RAILWAY CARS.

The running of a railroad in Germany is evidently accompanied with unpleasantness, if one may judge from the accompanying photographs. The Potsdam shops, which are responsible for the proper maintenance of rolling stock, have been confronted with the difficult task of disinfecting the cars. It seems that the coaches which return from Russia are literally a-swarm with vermin. Even after the cars had been cleaned with true Teutonic thoroughness, there was still the possibility that living disease germs might lurk in the walls and hangings. It was therefore, the practice for some years to take down all the upholstery, curtains, etc., and to clean everything thoroughly. Naturally, the expense involved was heavy and the cars were withheld from service for a considerable time. Moreover, there was also the danger of infesting the shops and other cars.

The problem seems to have been successfully solved by Julius Pintsch, who applied to the railway car a principle of disinfection which has been successfully employed on vessels. His disinfecting apparatus consists of an iron cylinder built up of cast iron annular sections of 16 feet internal diameter. The inside length is about 72 feet. The cylinder is so stoutly constructed that it can easily support without deformation a 30-ton car.



The huge cylinder in which German railway cars are disinfected by steam and formaldehyde at Potsdam after their return from a trip to Russia.

During disinfection the air within the cylinder is considerably rarefied by a pump, and as a result, the outer air exercises a pressure of about 1,900 tons on the disinfecting cylinder. Since the apparatus is heated during disinfection allowance has to be made for expansion. Hence the cylinder is mounted upon rollers, so that the apparatus can yield to an extent of about three-quarters of an inch in length, which is the amount of expansion.

Before it is run into the cylinder, all the windows and transoms of the car are opened. By means of a crane a two-ton closure is brought against the open end of the cylinder. A rubber gasket is employed to make the closure hermetic. Huge bolts hold the closure, gasket, and cylinder together. Steam is blown into the interior of the cylinder. Two hundred and fifty steam pipes line the interior of the cylinder, all receiving their supply from the main pipe. The total length of all these pipes is about 1¾ miles. In order to heat the air within the cylinder quickly and uniformly, two blowers are set in motion, so that all the air is brought in contact with the heating tubes. Even during the coldest weather the temperature within the cylinder can be raised to 140 deg. F. in from one to two hours. In order to heat an entire coach to this temperature, about five hours is required. After the car has reached the proper temperature, the air is pumped out of the cylinder until a vacuum of 70 to 74 centimeters of mercury under the normal pressure is obtained. At this atmospheric pressure water will boil at 104 deg. F. Hence all moisture is evaporated from the car without injuring the parts by the excessive heat. In no other way is it possible to kill vermin effectually. The upholstery, curtains, hangings, etc., are not in the least injured.

For very special purposes the cars may be disinfected with formaldehyde gas. At the very first attempt a car was thoroughly purged of vermin. To make assurance doubly sure, and to test the efficacy of this formaldehyde disinfecting method a glass vessel full of the living insects had been purchased from a professional vermin-exterminator in Berlin. This vessel was placed in the car and covered with cotton and linen. The insects were all killed.

The apparatus has also been employed to dry out wet cars as well as cars pervaded with the unpleasant odor of cooking. After twenty-four hours they were quite ready for service again. In this case no formalin was used.

Sealing the cylinder with a two-ton gasketed closure before exhausting the air and turning on the steam.

THE DISINFECTION OF RAILWAY CARS.

Liniment for Burns.—40 parts sugar lime, 10 parts glycerine, 30 parts carbolic acid oil, 3 parts salol.

GOVERNMENT IRRIGATION IN THE YAKIMA WATERSHED.—THE TIETON CANYON CANAL.

BY DAY ALLEN WILLEY.

The region adjacent to the Yakima River in southern Washington is the location of a group of irrigation projects which are notable for the engineering features. The topography of the country reveals a number of areas of arid land, separated by hill ranges which prevent water being distributed from a single source of supply. The engineers of the Reclamation Service have made an investigation which extended from the lower portion of the Yakima River to its head waters in the foot hills of the Cascades, and have planned five reservoirs and distributing systems, which will have a capacity to irrigate no less than 350,000 acres, making this group of projects one of the most important in the West. The various works are the Tieton, Sunnyside, Wapato, Kettitas, and Benton. They have a water supply through the rivers from four lakes and a submerged "meadow" having a total area of 574 square miles.

While the lower section of the Yakima River is used in part for what is known as the Sunnyside project, most of the service is performed by the Tieton, the Naches, and the Cowiche streams—small rivers which are feeders of the Yakima.

Of the projects, the Tieton is most interesting from a scientific standpoint, owing to the difficulties along the route, the various applications of power, and the fact that without the use of concrete the project would have been impossible. This stream flows through a deep canyon with very steep sides, the height of the bluff ranging in places as high as 400 feet from the bed of the river to the level of the canal. The water of the Tieton is diverted by means of a concrete dam thrown across the stream. Although but three feet high and 200 feet long, the reservoir thus made is sufficient to fill a main canal 12 miles long and lateral canals having a total of 51 miles. In conveying the water from the dam to the point of distribution, the only practical route which could be located was largely along the side of the canyon near the top, the rim being of such formation that it would be impossible to build a tunnel or open canal upon it. Consequently, several miles of the conduit were supported upon hinges or arms of reinforced concrete anchored into the rock and extending outward from the canyon side. The Tieton project contemplates the irrigation of from 24,000 to 30,000 acres of land in the vicinity of North Yakima, Wash.

As the water is conveyed along the precipitous side hill of the Tieton canyon, for 20 per cent of the distance the canal lies in tunnels. The open canal sections are of semicircular form, 8 feet 2¾ inches in diameter, with concrete shell 4 inches thick, while the tunnel sections are of circular form, 6 feet 1¼ inches in diameter, with concrete shell 4 inches thick. This canal and tunnel lining are made up in 2-foot lengths, manufactured on the flats along the river bank, where concrete ingredients are readily obtainable, and lifted to the canal line by cable hoists operated by electric power. These hoists are used successively at points about two miles apart, and the concrete shapes are transported along the canal between hoists on railroad tracks laid in the bed of this excavated route.

This plan was adopted for the reason that beds of sand suitable for concrete were found in the bottom of the river. In fact, the Tieton valley was made the site of a novel concrete works. The question as to how to transport them to the work was answered by the use of electrical power. A series of tramways were built at convenient points up the side of the canyon operated by cable hoists. These hoists in turn were served by a series of electric motors securing current from a power station constructed for the purpose. The concrete as fast as mixed was molded to the proper dimensions in portable molds mounted on wheels, so that they could be drawn from place to place. After hardening had taken place, the forms were set upon trucks having sides of steel framework. These trucks were mounted on the tramway, and the material hauled to the top ready to be set in place.

On the Tieton project 10,000 feet of tunnel were necessary, divided into two sections of 3,000 feet each and one of 4,000 feet. In excavating these much of the formation was found to be of black basalt rock requiring special machinery to remove it. In making the tunnel excavation a circular bore 7¼ feet in diameter was driven by machine drills. Tieton River has a fall of from 50 to 60 feet per mile, and advantage was taken of this to develop the power required for operating drills and other machinery and for lighting purposes. A power canal 3,500 feet long, of 180 second feet maximum capacity and 34 feet effective head, has been completed, which supplies water for operating a Franklin air compressor capable of compressing 1,250 cubic feet of free air per minute to a pressure of 105 pounds per inch, a Westinghouse generator of 120 kilowatts capacity, and one set of 26-inch twin turbines.

About 500 horse-power is developed, ample to operate the six electric drills, six air drills, shop machinery, pumps, hoists, etc., and to light all the camp buildings. The turbine is regulated by a governor, and the power canal is provided with an ample automatic overflow, just below the power house. An electric transmission line, carrying 2,300 volts, has been constructed to the upper portal of Trail Creek tunnel, a distance of seven miles. Electric drills are being operated at the two portals of Trail Creek tunnel, and at the upper portal of Tieton tunnel. At the lower portal of Tieton tunnel, and at both portals of North Fork tunnel, air drills have been installed.

Another difficulty in the way of building the Tieton project was the crossing of a number of ravines carrying small streams. A part of these were diverted into concrete flumes, while other conduits for them were made from rubble masonry. These culverts are of the arched type and vary in width from two feet to eight inches, the size of the larger ones being necessary in order to allow for the flood currents through the ravines. The total expense of constructing the

Tieton project is very small considering the work which had to be performed and the acreage which will be served by the water, a tract which will aggregate about 30,000 acres in all. In the construction work it was necessary to have a telephone line 33 miles in length, wagon roads along the route of the canal, and tunnels as well as temporary settlements for the workmen in the valley and on the rim of the

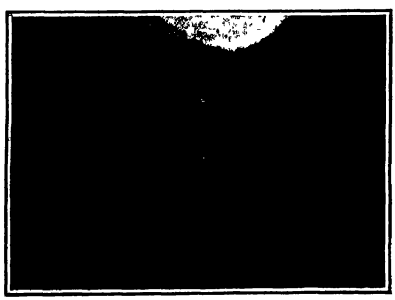
The canal consists alternately of open semicircular concrete conduits and circular tunnel.

Building the open section of the Tieton conduit. Note the wooden forms for the concrete.

One of the portable molds used in forming the concrete facings of the conduit.

The molding yard, showing the concrete lining sections ready for delivery at the canal

The 4-inch concrete lining was built in sections in the valley and lifted to place on the side of the canyon.



Side-hill excavation for the Tieton canyon canal.

GOVERNMENT IRRIGATION IN THE YAKIMA WATERSHED.—THE TIETON CANYON CANAL.

canyon. The land, however, is especially suited to the raising of forage, fruit, and hops and is located on three important railroad lines having connections with the principal cities of Washington.

Ointment for Burns.—Iodoform, 80 parts; extract of conii, 40 parts; carbolic acid, 1 part; rose unguent, 800 parts.

Increased Cost of Army Rations.

The numerous published accounts of high prices of food and the hardships which have been inflicted upon the workingman, and also the fact that hog meat has become so high in price that its use has been almost prohibitive, has resulted in a complaint from our Uncle Sam, to the effect that his army would have to substitute corned beef or corned-beef hash for bacon

To those of us who served in the Spanish war, and had the canned or corned beef served us as a part of the regular ration, the news will not come as a surprise, but the man who reads this will undoubtedly think of the good beef he gets at home and wonder why complaints should be made.

One particular reason why the army will now use corned beef is from the point of economy, for as mentioned before the price of bacon has so increased as to make the change desirable

The garrison ration is steadily increasing in price because of the general rise in the cost of food products. When the estimates for army subsistence were made last May for the next fiscal year, it was assumed that a ration would cost 20.97 cents. By January of this year the cost had increased to 22 cents, making it necessary for the War Department to submit a deficiency estimate to Congress. If the present rate of increase keeps up, the cost will be nearly 23 cents by the end of the next fiscal year When it is considered that the army annually consumes several millions of rations, it will be seen that an advance of even a fraction of a cent in a single ration means a big advance in the aggregate for a year

HOW GAMBLERS CHEAT

BY HERESWARD CARRINGTON

Games of chance have always had a fascination for all classes of individuals, at all ages, and the professional "sharp" has made this weakness (which in some persons is developed into a ruling passion) a means for earning an easy livelihood at the expense of the numerous "flats" who visit the race course or other places where gambling is looked upon as a more or less legitimate pastime. The ingenious mechanical devices which have been employed for this purpose are really astonishing. Such clumsy appliances as loaded dice are, of course, out of date, though one ingenious sharp invented a table the top of which was sheet steel under a very thin cloth covering. By means of an electro-magnet concealed within the table, its top could be converted into a powerful magnet, and the dice (which were prepared by having one side of metal while the rest were ivory) could be attracted to the table when the current was on or would fall in any haphazard position when the current was shut off. Dice, however, are generally suspected and hardly anyone would venture to stake money upon the fall of the dice any more than he would upon three card monte.

Cards are the most fertile field for the gambler's revenue. Winning at cards depends largely upon the possession of certain high cards or the aces which win the tricks and to gain possession of these cards is the gambler's object. For assuring this various devices have been employed called "holdouts" mechanical contrivances concealed in the sleeve which by a very slight pressure or movement in one direction, will instantly shoot out the required card into the gambler's hand and recede again into the sleeve. One of the most ingenious and perfect of these was invented by a gambler named Keplinger and the device has ever since been known as the "Keplinger holdout." The apparatus was worked by the knees, so that no motion of the arms or body was necessary. A slight separation of the knees was all that was required to shoot the card into the gambler's hand. The knees were thereupon relaxed and the "holdout" receded like a flash into the gambler's sleeve.

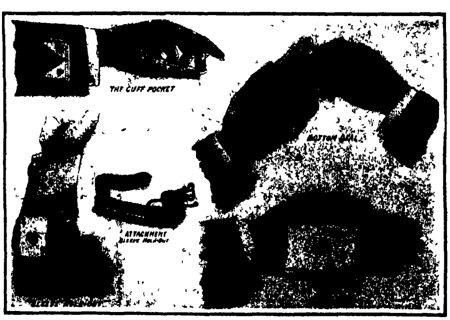
Another variety of holdout is that concealed in the waistcoat, and here the hand is held close to the body with the cards outspread while the thread is pulled, and in that manner a card shot into the hand under cover of the remaining cards. This however, is a dangerous procedure which is rarely employed. A small but ingenious species of holdout" is that known as "the bag." The small sharp point seen in the illustration is stuck into the wood of the under side of the table in such a manner that the flat bar runs along parallel to and just touching the wood of the table beneath. One or more cards are now inserted into the clip thus formed, and may be withdrawn by the fingers in the act of drawing cards on the table toward the body.

A daring yet simple variety of "holdout" is attached to the sleeve. It is buckled around the shirt sleeve under the coat and two small pointed hooks facing outward press against the coat sleeve. These hooks may be separated or brought nearer together by pressing upon a small rubber tube. If now a card be placed against the coat sleeve, on the outside, and the clips separated and then released, they will clasp the edges of the card through the cloth of the coat, and it will be retained there by the pressure of the spring in the "holdout." So long as the arm be held *downward*, the card is invisible, but the card may be obtained possession of by the fingers of the other hand when resting against the sleeve of the arm to which the "holdout" is attached.

A still simpler device is to have a small pocket cut in the coat sleeve at the seam. The "pocket" is merely a slit about three inches long, into which the required card is inserted. The fingers grasp the card and withdraw it with the others at the required moment. Another variety of "holdout" is known as the "ring holdout." A ring is worn on one of the fingers, to the inside of which is attached, as part of the ring, a small wire clip or spring, flesh colored. The card is inserted under this spring, and in that manner is retained within the palm of the hand by the pressure. Experts in sleight-of-hand would not require a clip of this character, being enabled to palm the card without any mechanical aid.

Besides such devices as those just mentioned, the gambler depends for his success partly upon his dexterity in handling the cards during the actual progress of the game. Of course marked cards are frequently employed for this purpose but the expert gambler will succeed in marking the cards with his thumb nail during the course of the play, so that, at the end of a few hands he knows practically every card in the pack from the slight indications upon its back. Sometimes, also cards are bent more or less slightly to insure their recognition—either individual cards or a number of cards together. If half a pack is bent in this manner this is called "the bridge." Each card in this section then has a slight curve, as shown in the illustration.

THE ELABORATE OUTFIT OF THE GAMBLER.



SOME GAMBLERS' TRICKS WITH CARDS.

A gambler may even deal to himself or to any person forming the circle a particular card which is known to him. This card is at the bottom of the pack, and the "sharp" deals off the cards from the top of the pack continuously until he reaches the person into whose hand he desires to place the card next to him, when, by a rapid movement, he withdraws, not the top b' the bottom card with his fingers instead of his thumb. This trick, when rapidly and well executed, is practically undetectable.

Card "sharps" also employ other devices for gaining knowledge of the cards dealt to every member in the circle. In order to gain this knowledge, a small mirror is employed. Sometimes this mirror is attached to a needle point, and fixed to the under side of the table nearest the dealer. If, now, in dealing, each card be passed over the mirror in turn, the gambler will be enabled to tell the position of each card dealt, and to follow the cards before a single play can be made. A mirror of this character is a dangerous device, and it is easily detected. For this reason, very ingenious schemes have been employed. A small mirror is inserted into the bowl of a pipe, laid carelessly on the table, the bowl being turned slightly upward and toward the dealer. Now, in dealing the cards, they are passed each in turn over the bowl of the pipe, and in this manner the magnifying glass it contains conveys to the "sharp" all the required knowledge as to the cards contained in each sitter's hand. Occasionally "sharps" employ a mirror ring for this purpose, a large signet ring being used which during the course of play, is swung around so that the signet faces the palm instead of the back of the hand. The signet then swings open on a pivot hinge and discloses a tiny magnifying mirror beneath. By the aid of this mirror, the majority of cards can be detected as dealt. At least aces and court cards can be distinguished from cards of lower values, which is the chief thing to be discovered.

There are a number of other ingenious devices employed by professional sharps, but the above will at least give the reader an idea of the extent to which this practice has been carried, of the remarkable ingenuity displayed by manufacturers of such devices, and of the dexterity and daring of the gamblers themselves in employing them.

Macrographic Examination of Metals.—The macrographic examination of metals consists in examining with the naked eye the surface of the metal, which has been polished and chemically treated in such a manner as to bring out its constitution and its impurities. In micrographic or microscopic examination the particular objects of study are the character and chemical properties of the alloy, while macrography concerns itself with the physical properties. The principle of the methods used is as old as the first methods of damascening, in which an acid mixture was employed which blackened in different degrees the strips of iron and steel which had been welded together in the formation of sword blades.

The operations of macrography are essentially two: first, the preparation of the polished surface, which must be absolutely free from grease, secondly, the chemical treatment, which is preferably effected with dilute sulphuric acid, in which the entire piece of metal is immersed for several hours, or with an aqueous solution of iodine and potassium iodide. The indications furnished by the examination of the surfaces thus treated are useful in determining the quality of steel and detecting the presence of slag and of blowholes. When a bar of metal is cast there is frequently produced near the surface a blowhole which is filled with the more fusible impurities. Usually this pocket extends through one-third of the thickness of the bar. Macrographic methods show whether the blowholes have been obliterated either by pressure or by removal of the upper part of the bar, and they are also capable of detecting in forged pieces traces of these blemishes which have been left after the tooling.

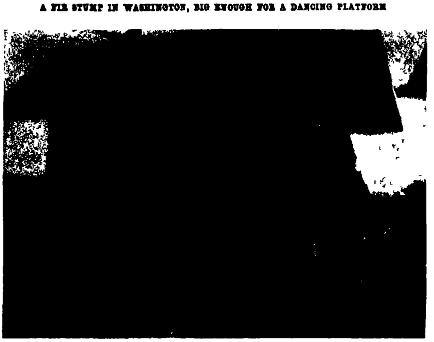
The statistics of the American Railway Association show that the net surplus of freight cars on the railways of the country on February 16th was 14,[illegible], as against 24,975 on February 2nd; 24,844 on January 19th; and 28,416 on January 5th. The increased demand for box cars and [illegible] cars has [illegible] to call into service all idle [illegible]

BIG FIR TREES OF THE NORTHWEST

The fir trees of the Pacific Northwest occasionally attain such proportions, especially in the territory near Puget Sound, that the stumps after the trees have been cut down are employed for novel purposes. In some portions of Washington one can see these huge stumps, which have been hollowed out and actually made into temporary homes for settlers. To make a stump house, it is only necessary to remove the material from the interior, leaving enough to form walls of suitable thickness. Then a roof of boards or shingles is put over the top of the stump, holes are cut for windows and doors, and the dwelling is practically ready for occupation. A number of these stumps have been used by settlers on what are called logged-off lands, until they have been enabled to construct larger and more convenient dwellings. After the stump home has been vacated, it is turned into a stable for the horses, or sometimes into an inclosure for chickens or hogs.

Next to the big tree of California, or sequoia as it is termed by the scientists, the fir as found in Washington and Oregon has the largest diameter of any tree in America, and probably in the world. Some have been cut down which actually measured 15 feet in diameter at the point where the incision was made. As they decay very rapidly after the timber has been removed, usually the interior can be hollowed out with little difficulty. Sometimes they are used for dancing platforms, as is shown in the accompanying illustration, some being large enough to accommodate four couples. An other custom is to turn the big stumps into playgrounds for the children, who reach the top by pieces of wood nailed against the sides or by ladders, and a pretty sight which a traveler often sees in the northwest is one of the big stumps turned into a flower bed and covered with the trailing vines.

A FIR STUMP IN WASHINGTON, BIG ENOUGH FOR A DANCING PLATFORM



STUMP OF A FIR TREE IN WASHINGTON WHICH SHELTERS A FAMILY OF FIVE

How to Repair and Clean Typewriters.

BY LOUIS A. FLEMING

As every user of a typewriter knows, the platen or roll is the part of the machine that wears out first. The constant hammering of the type against the surface of the platen soon makes indentations in it, which in a short time amount to such a degree of roughness that it is impossible to produce good, clean work.

A compound has recently been discovered that will restore the platen to its original smooth condition no matter how badly it is worn or how long it has been in use.

The formula and method of using the compound are as follows. The ideal material for use in repairing platens would be hard rubber, but in the process of vulcanizing, the rubber becomes insoluble to a great degree in the solvents generally used for making rubber solutions. As a substitute for hard rubber *celluloid* is recommended. The hard variety should be used, which is sold under the name of imitation ivory. This is soluble in acetone, amyl acetate, and various other solvents. One of the best solvents is a mixture of eight ounces of acetone and one ounce of amyl acetate.

In the absence of anything else in the way of celluloid, any ordinary article made of this substance, as a comb, may be used. There is a variety of celluloid used in the manufacture of combs which is quite satisfactory for this purpose. The color also is good where this variety can be obtained.

In using celluloid on platens it is advisable to use something with it that will give it hardness, such as finely powdered silica, infusorial earth, emery, or other similar substances. About one ounce of powdered emery to each eight ounces of compound is a fair proportion. Powdered soapstone also works well for the purpose.

The celluloid solution should be made as thick as a very heavy syrup or molasses. In fact, as thick as may be spread with a brush. The heavier it is when used, the sooner it will dry. If a light colored celluloid is used, it is advisable to add some coloring matter, which may be lampblack or preferably gas or carbon black. [illegible] enough should be used to give the desired grayish color. Remove the platen from the machine. The work may be done with the platen in the machine, but great care must be taken to protect the working parts from the dust formed when smoothing up. It also takes less time to do the work when the platen is removed.

Wash the platen with gasoline to remove all grease and dirt, and rub it with a piece of fine emery paper, to give it a new, clean surface. With a brush, paint the mixture carefully over the platen, giving it a good thick coat.

Lay the platen aside for six hours or longer for the composition to harden. Then with a piece of fine emery cloth smooth it down, taking care not to cut quite to the original surface of the platen. This is the delicate part of the work, and upon the care used in doing it depends the quality of the job.

Acetone and amyl acetate can be obtained at any drug store. It usually requires from two to five hours for the celluloid to dissolve. Breaking it up into small pieces hastens solution. The solution should be prepared in a wide-mouthed bottle that can be securely corked. It should be shaken often during the process as this will prevent the celluloid from forming in lumps. The bottle should be kept tightly corked and away from fire, for it is highly inflammable. Should the mixture become too thick, thin it with a little more of the solvent, if it is not thick enough, add more celluloid.

A cheap and simple cleaning compound for type writers is composed of the following ingredients:

Paraffin oil	1 pint
Benzol	5 ounces
Cresol	1 drachm
Kerosene	4 ounces

Mix thoroughly.

This compound was for years a secret confined to one or two of the large companies that rebuild type writers. The machine is immersed in the compound which quickly and thoroughly dissolves and removes all dirt, gum, grease, etc. It does not injure the enamel, but on the contrary improves its appearance, making it as bright as when new. In making up any desired quantity of this compound retain the proportions given in the formula, except that should a quicker drying mixture be desired the quantity of paraffin oil may be reduced and the kerosene increased. In all cases the lightest grade of paraffin oil should be used and not the heavier lubricating oils. If white paraffin oil is used a water white fluid is produced, if dark paraffin oil is employed the liquid has a light amber color. Oil of citronelli or oil of sassafras may be substituted *for the cresol* which has no action whatever and is used simply to disguise the composition of the compound. To use the compound fill a tub of sufficient size with it. Place the machine in it and allow it to remain in the fluid for half an hour. By lifting it up and down gum and grease will be washed off. Then remove it and dry it with a soft cloth brushing the parts not accessible with the cloth. About two gallons of the mixture are required in the average case. The compound may be used as long as any of it is left, as the dirt settles to the bottom of the tub and the clean portion may be drawn off. It is necessary to keep it covered tightly when it is not in use to prevent evaporation of the benzol. A fair preparation may be made by using one-third the quantity of paraffin oil mentioned in the formula, an equal quantity of kerosene and from one and one-half to two times as much gasoline.

The Transformation of Sea Water Into Fresh Water

The belief was prevalent among the savants of the 17th and 18th centuries that a hermetically sealed earthen vessel dipped into the sea would fill itself with fresh water. At the present day it is difficult to say on what this belief was grounded. It surely could not have been evoked by experiment. In a similar sense Marsigli, the founder of oceanology, made in the year 1725 an experiment which effected the filtration of sea water through a system of fifteen pots filled with washed garden-earth or sand and so placed as to let the water fall as if in a cascade. It is stated that the palate disclosed a definite diminution of the presence of salt. Similar assertions are everywhere current among seamen.

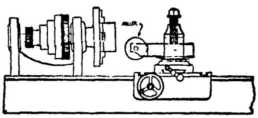
A scientific test of the endeavor to free salt from water was recently made by the French investigator Thoulet. His report which appears in the minutes of the Académie des Sciences of Paris states that the presence of salt can be reduced by filtration. Forty centimeters of the length of a glass tube which was one meter long and was placed in a perpendicular position was filled with sea sand and the rest of the tube was filled with sea water. Portions of the filtrate were examined at intervals of the experiment to ascertain its density and chemical composition. The result was that in the initial stage of the experiment density as well as saline content were found to be moderately reduced, very soon thereafter both recovered their original value. The early decrease of value is explained by the mechanical attraction which every chemically neutral body exercises on the molecules of a substance in solution as soon as the body comes in contact with the solution. In nature too, sand fails to effect the separation of salt. Through shipwrecked seamen it became known that relatively fresh water may be found on very low and barren coral reefs in the Pacific Ocean by digging to a trifling depth in the coral sand. It is not however as was supposed sea water freed from salt through the layers of sand but is simply rain water that is retained by a sandy stratum and by it protected from admixture with the sea water. Similar phenomena may be observed on the European coasts. They may be considered the key to the popular belief now contradicted, that sea water can be sweetened by filtration through sand.

According to the Electric Railway Journal, a novel type of electric locomotive has recently been built for canal haulage near Bremen. The locomotive runs on a quay which has to be kept clear for the passage of drays and for other purposes. To secure the necessary weight for adhesion it was decided to build the locomotive in the form of two U's with a connecting girder. The current is taken from overhead wires.

A TOOL FOR CENTERING WORK IN A LATHE

BY H D CHAPMAN

The accompanying drawing shows a handy tool for centering work in a lathe chuck When a job is to be faced off it requires a little time to get it to run

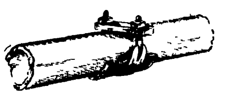


SIMPLE METHOD OF CENTERING WORK IN A LATHE.

true The drawing shows how the work can be expedited by the use of a simple tool The tool is made of tool steel, the roller is hardened When a job is placed in the chuck to be faced off and the face of the work does not run parallel with the face of chuck the roller tool is secured in the tool post, and the lathe carriage is then run up by hand until the roller strikes the face of the job As the work wobbles in the chuck the high position will be struck by the roller and forced true with the face of the lathe After the work has been trued it is then ready for machining

REPAIRING A LEAK IN A STEAM OR WATER PIPE

A pinhole will occasionally cause a leak in a steam or water pipe, after the piping has been put up and perhaps been in use for a considerable time It can be repaired with an ordinary carriage clip and yoke



MENDING A STEAM OR WATER PIPE.

and bit of sheet rubber packing, although a piece of an old rubber shoe would last for years

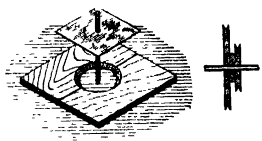
You can readily see the application by referring to the sketch The writer stopped two leaks in steam pipes fifteen years ago by this method The pipes have been in service ever since and have not leaked They were both in rather inaccessible places, where it would have been difficult to renew the pipe At the same time being in out-of-the-way places the appearance of the patch did not matter

GROOVED PULLEYS FOR EXPERIMENTAL WORK

BY CHAUNCEY W NIKMAN

Small grooved pulleys or sheaves can of course be turned on the lathe but a substitute for the lathe which in some respects is quicker and cheaper, will be found very advantageous The description of such a method follows

In a piece of wood of the thickness desired for the pulley bore a hole of a diameter equal to that of the pulley at the bottom of the V-groove With a half round rasp or large drill countersink this hole on both sides Split—do not saw—the board in two down the



MOLD FOR CASTING PULLEYS.

middle of the hole, then nail or clamp it tightly to a smooth board the two halves being pressed firmly together Find the center of the hole with a compass and drive in a headless nail taking care to get it vertical, to serve as a "core" for the bearing Have handy a piece of cardboard considerably larger than the pulley, with a hole in its center the size of the nail Pour melted solder into the mold, and quickly slip the cardboard over the nail and down upon the mold This will force out superfluous metal and make the upper side of the pulley smooth When cool, unclamp the mold and pull apart where split. A knife or rasp will then do all the finishing necessary Two or more pulleys can be cast together by placing the molds one upon the other, with their centers common. The figure shows such a combination. A hub may be made in a similar way If a stronger bearing is wanted, as for an idler, wrap a strip of brass around the nail and let it become soldered to the metal

Along similar lines a cogwheel may be cast, but great care is necessary in cutting the teeth in the wooden mold A large number of pulleys can be cast from one mold, and for duplication work this method will be found quicker than the lathe.

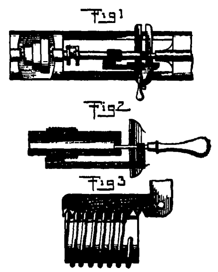
HOW TO CUT THREADS WITHOUT A SCREW-CUTTING LATHE OR THREAD-CHASING TOOL

BY JOHN BERGSTROM

The ordinary way to cut a thread by hand is to use a thread-chasing tool with the number of teeth per inch wanted The difficulty in chasing a thread is in the starting It takes a great deal of practice, and even then a "drunken" thread may be the result

The accompanying illustrations show how this can be done in a very simple way and yet give an absolutely true thread

If a number of screws are to be cut the best way to proceed is as follows Take a thin piece of tubing that will just fit over the bar or bolt to be threaded In one end drill a small hole, into which fasten the end of a spring brass wire, preferably by soldering Then wind the wire around the tube half a dozen or more turns Now take a thread gage Select the number of threads per inch wanted and place it lengthwise of the tube, bringing one turn of wire in each



SCREW-CUTTING ATTACHMENT FOR LATHES.

notch, after which pull the free end of the wire and keep it tight Solder the coils to the tube, using only the corner of the soldering iron then move the gage one-third of a turn around the tube and repeat the soldering and finally move the gage again an equal distance and solder

It will now be seen that there is a perfect thread or spiral around the tube, which we will call the master thread This master thread must be slipped on the bar or bolt to be threaded so that it will not turn, allowing enough room at the end for the threads to be cut. The cutting tool consists of an ordinary hand tool, with only one point. Procure a small piece of wood, long enough to reach over the master thread and to the end of the bolt. Into this piece of wood drill a hole just large enough for the cutting tool to slip through and fit snugly

In operation the cutting tool is held in the right hand, in the usual way Then with the left thumb press the piece of wood against the master screw and start up the lathe The master screw will feed the cutting tool the right pitch As soon as a good start is obtained the tool will feed itself without the aid of the master screw

When the thread is finished the master screw may be removed and slipped over another bolt to be threaded The spiral may be wound right or left, according to the direction wanted Any number of threads may thus be formed That is to say if a triple or quadruple thread is wanted, it is only necessary to wind three or four wires around the master thread and proceed as before described This arrangement is also very handy in starting a thread when the ordinary chaser is used, as it will always insure a straight thread It is not necessary to nick or mark the wooden block, as it readily takes the impression of the thread from the master screw

Fig 1 illustrates a plan view of an ordinary lathe, ready to cut a thread Fig. 2 shows how internal threads may be cut and Fig. 3 shows the master thread.

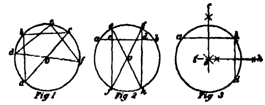
SIMPLE METHODS OF FINDING THE CENTER OF A CIRCLE.

BY AUGUST MENCKEN

Very often it is necessary in the drawing room or shop to find the center of a circle, a disk or a piece of shafting, etc., when the diameter is not given Below are three ways in which this can be done

The first, Fig 1, is the method usually used It consists of two right triangles drawn so that their angles are in the circumference of the circle as $a\ b\ c$ and $d\ e\ f$ The point where their hypotenuses intersect is the center of the circle

The second method is shown in Fig 2 Draw any chord as $a\ b$ and take two points on it as $c\ d$ equidistant from its ends. At these two points erect perpendiculars to $a\ b$ cutting the circle at $e\ f\ g$ and h Then



THREE WAYS OF FINDING THE CENTER OF A CIRCLE

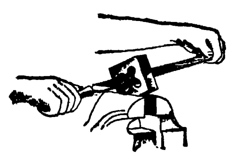
draw $e\ h$ and $f\ g$, and the point where they intersect will be the center of the circle

Fig 3 is similar to Fig 2 Draw any two chords as $a\ b$ and $c\ d$ and at their centers erect perpendiculars to them The point where the perpendiculars meet will be the center of the circle

HOW TO SHARPEN A PIPE DIE.

BY ALFRED F BISHOP

I discovered a short time ago that a mill-cut file would sharpen a solid pipe die quite easily and quickly without removing the temper in the die The first few rubs of the file will slide without cutting, this being due to the grease on the die Just as soon as the greasy surface is thoroughly worked off,



A PIPE DIE CAN BE SHARPENED WITH A FILE.

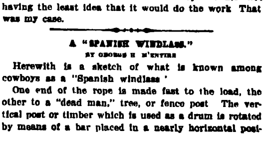
the file will commence to cut, and will cut very smoothly making a keen edge on the cutting thread Heretofore I have always worked on emery grinders to try to do this work without removing the temper of the die, but found they worked very slowly on account of the small diameter of the wheels, also that it was quite a nuisance to set the die for the cutting wheel Most mechanics would not try the file not having the least idea that it would do the work That was my case.

A "SPANISH WINDLASS."

BY GEORGE H M'ENTIRE

Herewith is a sketch of what is known among cowboys as a "Spanish windlass"

One end of the rope is made fast to the load, the other to a "dead man," tree, or fence post The vertical post or timber which is used as a drum is rotated by means of a bar placed in a nearly horizontal posi-



A "SPANISH WINDLASS."

tion bearing against the vertical post but not fastened to it. The rope is passed around the end of this horizontal bar

One man holds the post against the ground and vertical, and a second man walks around with the bar passing it above the rope, and thus winding the rope on the vertical post.

The whole windlass moves toward the "dead man" as the rope is wound on, so no permanent hold can be

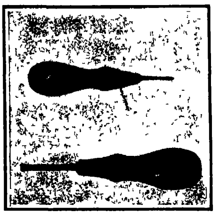
made in the ground for the vertical post to turn in.

This windlass is very useful for pulling wagons and autos out of the mud. All one needs is a rope and two posts or timbers.

THE WEIGHTING OF TOOL HANDLES.

BY A. J. JARMAN

How often it occurs that when a tool such as a brad awl or particularly a keen-edged chisel is thrown down in a hurry it will roll off the bench and fall upon the floor, perhaps into a glue pot or upon the foot of the workman, or on a hard surface that will nick or dull the cutting edge. The following little scheme is employed with all the wood-working tools of the writer and found to answer admirably. Bore a hole in that part of the handle that rests upon the bench, with a five-eighths rather dull cutting twist bit. Bore the hole only as far as the center of the handle, but no farther, or the object desired will be defeated. A dull cutting bit makes a rough-sided hole. Into this pour some melted lead (of course the lead should not be too hot). When the lead becomes set, trim it off evenly with a fine rasp and finish off with coarse sand paper. Now when the tool is thrown down hurriedly upon the work bench it will not roll over more than once and will come to rest leaded side down. This little dodge is not only inexpensive, it is thoroughly effective, it will not only save annoyance, it will prevent many an accident, which no one can realize more than the man who is handy in the use of wood working tools.



BRAD AWLS WITH HANDLES WEIGHTED TO PREVENT ROLLING.

The illustration shows two brad awls, fitted as described, and used by the writer for several years.

AN ILLUMINATED GAS HEATER.

BY F. G. WILLIAMS

The accompanying illustrations show how an illuminated gas heater can be made. The heater is mounted on a suitable pedestal, such as a wrought-iron stand or a base of some old discarded oil lamp. The heater proper consists of a burner *A*, a screen *B*, and an outside cover or shield *C*, which is removable. A suitable handle is provided at the top of the cover for this purpose.

Through the base passes an ordinary gas pipe, and at its lower end a stop-cock is fitted with a suitable attachment for a rubber hose so that it can be connected to the gas supply in the usual manner. At the upper end of the gas pipe is attached an adjustable sleeve for regulating the proper proportion of air to be mixed with the gas. The sleeve terminates in the burner proper, which is made with double walls. The lower part is made conical, so as to better distribute the mixture of gas and air. The burner proper is made from ordinary culinary utensils, the inside part from a small pan, and the outside part is made from a colander with very small holes, the smaller the better. These two parts are riveted together at the top, so as to make them tight. The lower or conical part may be made from ordinary black iron and may be fastened to the upper part as well as to the lower or gas pipe in any suitable manner, as by riveting or seaming.

The screen is made of wire netting fastened together, forming a cone with the same taper as the burner. The upper strands are bent inward so as to serve as a support for the cone. On this screen long asbestos fibers are attached. The raw Canadian rock asbestos is procured and the fibers pulled out in long threads, sometimes two or three inches long. These fibers are fastened and spread all over the surface on top of the perforations in the burner, and when the gas is lighted an incandescent mass will be formed which radiates heat but is not consumed. The outside cover is also made from some sort of pot or pan, provided at the top with a suitable handle, terminating with a downwardly extending rod, which passes through holes in the top of the burner proper and fits into a small socket at the lower or conical end. This is for the purpose of keeping it securely attached to the same. A number of holes at the top should be made for the circulation of the air and spent gases.

The cover may be cut out or perforated in such a way as to represent a landscape or any conventional design. The inside of the shield may be lined with mica so as to render the heater more safe. The mica may be tinted in almost any color desirable. Aniline colors are dissolved in amyl acetate, then mixed with amyl acetate collodion (commonly called banana oil). This mixture is applied with a soft brush and will dry very smooth. It will withstand a great deal of

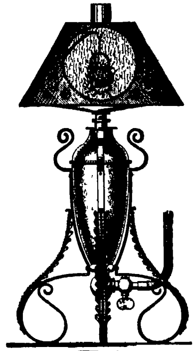


Fig 1

A GAS HEATER IN THE FORM OF A LAMP

heat. When the burner is lighted the gas will burn and form small blue beads on the outside of the perforated burner, and as the flame strikes the asbestos fibers it will make them glow very brilliantly and change colors as the fibers are moved to and fro by the currents of air passing between the cover and the burner.

If artistically made the heater may be used on the top of a table and will be a real ornament to the house but, of course, will show off to a better advantage in a dark room. The outside cover is not at all necessary, but is only used to get the desired effect.

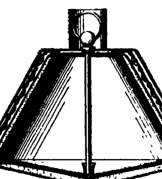


Fig 2

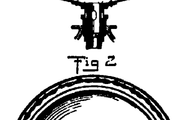


Fig 3

SECTIONAL VIEWS SHOWING DETAIL OF CONSTRUCTION.

FILES AND THEIR USES.

BY HOMER CLOUKEY

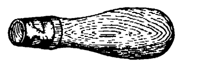
Nearly everyone who has had much filing to do, knows what a difficult thing it is to get hold of a reliable handle. Wood ones will split even if ferruled, or the brass ferrule will become battered and weakened. Steel ones are rarely satisfactory, and the set screws are always in the way. The following is a simple method of reinforcing the file handle: At the end of the file handle turn two 3/8-inch grooves, placing them 3/8 inch apart. Connect by two diagonal grooves of the same size, wrap with a piece of paper, and pour Babbitt metal or solder in the top. Trim up, and you have an everlasting file handle.

A simple and inexpensive file cleaner is made by hammering either end of a medium or large sized common wire nail until it is flat. This tapering flat piece is then trimmed off square, with a file, and filed to an even thin edge. This cleaner is self adjusting to all files and is far more effective than the expensive wire brushes usually used.

Files as nearly everyone knows are made from the best of tool steel to hold a sharp and strong edge under tremendous strain. This steel primarily has to be capable of being easily worked and, after it is worked of holding the finest temper imaginable. It will be seen therefore that it must necessarily be the best of raw material for the articles enumerated below. It must be remembered that files have a very high temper, and therefore in all operations in which this degree of hardness is not essential, the temper should be drawn by heating and cooling down slowly in order to render the steel less brittle. In fact, the temper and quality of a good file are instanced by the fact that the writer has seen made and has tried satisfactorily a razor ground from a 10-inch flat mill file on a regular emery wheel and then honed and stropped into shape.

Perhaps the first use I ever saw old files put to was a full set of nail sets made from 6-inch triangular files by snapping them off to an even length at five inches and grinding the points down to various sizes required. The top ends were rounded off nicely, and the teeth were ground just enough to give a beautiful knurled effect to the set. I asked the mechanic who made these tools why he hadn't used rat-tail files and make them round, but he said he just wanted them different from the common run of tools. Some years later I did have the pleasure of seeing a beautiful set made from round files. Only with these there was left an unground strip between the two ends, to afford a good grip for the fingers.

Another splendid set which was evolved out of files



REINFORCED FILE HANDLE.

by a machinist who had occasion to do a little special pattern making from time to time, was a complete set of little V-shaped gouges and flat chisels and half rounds, all made with curved shanks to reach otherwise inaccessible places. These were made by forging small files of the requisite cross section into the curve required, and grinding the shank and edge to the tool desired. By requisite cross section I mean that he always took a flat file to make a flat chisel and a triangular one for a V-shaped one etc. When these were ground nearly to their finished sizes he hardened them by suddenly cooling in oil from a cherry red heat, and then tempered them to a medium straw and again cooled them, after which they were given their final grinding and sharpening. The tang on the file was just the thing to fasten the finished tool in a firmly ferruled handle, and his tool was complete.

If you want a good heavy center punch, snap off either a rat tail or triangular file of the right size to a convenient length, say five inches, grind a good long taper on it up to the last 1/4 of an inch, and make the taper shorter to give more metal to the point, and there you are.

Sometimes a file will help out a serious difficulty if it is only used. An occasion arose in which it was absolutely necessary to shear off some large spikes in some built up timbers that had already been placed in a building. It looked well nigh impossible until I thought to sharpen a file to an edge on the blunt end similar to a cold chisel, and by driving this in between the piles it was a simple matter to cut the spikes, though to tell the truth it spoiled the edge of the file several times before they were all cut.

Perhaps the most common use to which they are put is to make them into burnishers for sharpening cabinet scrapers and kindred tools. For these they are simply mounted in a handle and ground until they are perfectly smooth. Triangular files are the ones commonly used for this purpose.

A round file makes an efficient awl for any purpose and with scarcely any trouble to transform it ready for its new duties as it needs only to be sharpened.

An amateur desiring to take up brass craft work, and not wanting to pay the exorbitant price generally exacted for an outfit, decided to make one from files. In less than two hours he had made every tool illustrated in a large assortment, and they were a creditable-looking outfit, comprehensive enough for any ordinary purpose, and included all the customary piercing, denting, tracing, and stippling tools.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

HAT PIN ATTACHMENT.—C. T. Tolavitch, Baltimore, Md. This improvement provides a guard to be fastened over the point of a hat pin for preventing the latter from injuring persons in the vicinity of the wearer. The device can be applied directly to the point of the ordinary hat pin or removed instantly without screwing the guard to the pin or fastening it in any other way than by a slight pressure.

Electrical Devices.

COMBINED SPARK COIL AND INDICATOR.—F. A. Thorndike, Randolph, Neb. In this case the invention relates to electric spark devices. Mr. Thorndike's more particular purpose being to combine a spark coil with an appropriate indicator for disclosing the condition of the coil in order that the operator may readily ascertain if the spark is being made properly.

Of Interest to Farmers.

FRUIT-GATHERING VESSEL.—J. H. Onmes, Wenatchee, Wash. The device is for use in gathering fruit, vegetables, and the like. The inventor employs a body portion which is in the form of a metal or other pail which enlarges or tapers towards its lower discharge end so that the fruit may be freely discharged without bruising, binding, or choking in the discharge, and the pail is preferably made of an elongated oval form.

ELECTRIC VACUUM MILKING MACHINE.—G. B. Crame, Duquesne, Pa. This device is to a certain extent automatic in its operation and does not therefore require so much the service of an attendant. The invention provides a special form of electro-magnetic automatic vacuum shut-off valve for stopping the action of the vacuum on the cessation of the flow of milk, thereby avoiding all danger of injury to the cow which may be sensitive to a continued operation.

Of General Interest.

FUME ARRESTER.—C. C. Whitmore, Butte, Mont. More especially this invention is applicable to those furnaces in use in smelters in which certain ores are roasted which give off gases and fumes that are injurious to vegetation and which tend to render the atmosphere of the surrounding locality unfit to breathe. The device may be attached to the furnace of the ordinary smelter and by which the smoke and gases may be condensed and the injurious substances extracted.

COMPOSITE FABRIC.—I. Kraus and W. H. Faskins, New York, N. Y. This invention pertains to a fabric of the elastic type. An object is to provide a fabric which is strong, durable, and inexpensive to manufacture, and a fabric of high elasticity which will stretch readily without tearing the non-elastic components thereof.

DOOR STAY.—M. Logan, Plymouth, Ind. The invention relates more particularly to stays such as are adapted to be used on gates, screen doors, or the like whereby the doors are braced to insure their being evenly supported in normal condition. The aim is to provide a device which will prevent a door from sagging and which will always permit it to swing freely while being opened or closed.

SMOKING-PIPE.—C. I. Keefs, Franklinville, Pa. The principal objects in view are to provide a pipe which may be readily cleaned; one in which the nicotine bearing liquid of condensation is trapped in a member from which it is readily and quickly drawn, and to provide a construction whereby the ash and coked particles of the pipe structure may be readily removed.

COMPOSITION.—W. R. Humphreys, Springfield, Mo. The invention refers to waterproof polishing compounds and it consists in ingredients which are compounded in specified proportions. An object is to provide a metal polish which has the form of a paste and impervious to water. A further object is to provide a compound which cleanses as well as polishes.

COMB.—I. W. Glover, Chattanooga, Tenn. This comb is fashioned preferably from metal and formed from teeth assembled upon a rod, the teeth being suitably spaced and forced to attach to the rod under pressure, thus obviating the manufacture of the comb from the single piece of material while resulting in the production of an article substantially equal to one formed from a single piece.

SPIROMETER.—I. D. Childs, Chester, S. C. This invention comprises a cylindrically formed apparatus and is intended for use in the exercise of increasing the lung capacity of the party using the spirometer. There is very little space left between the movable part and the fixed part of the device, and when the movable part is in a certain position but little air remains to become putrid. A suitable mouthpiece is connected with the free end of the hose.

DISTILLING DEVICE.—O. A. Nenninger, El Paso, Texas. This apparatus comprises means for boiling water and adapted to connect either with a still or with the hot water boiler of a kitchen range when there is no fire in the range. A connecting system of valves and other appurtenances enable the desired connections to be readily made by throwing a handle member which controls the valves.

SHOW-CASE.—A. Reihla, Baltimore, Md. This invention is an improvement in show-cases such for instance as the ordinary inside show cases and cases in the form of show windows and the like. The inventor provides a channel strip which fits over the edge of one glass plate and is connected with the under surface of another. Cement is used within the strip and secures the latter in connection with the glass plate. In repairing or replacing glass a facing is used which can be severed by means which avoids cutting the cement which is difficult when the compound has hardened.

RAISING DEVICE FOR MOLDS.—J. S. Linton, Anderson, Ind. The aim in this invention is to provide a device for building a reinforced wall of concrete or the like, the mold thereof being adapted to be raised from and over the concrete wall after the same has sufficiently set and constituting the form for a second section of the same wall and so on upwardly until the wall is completed.

NECK YOKE.—J. Hulit, Silverton, Colo. The improvement is in neck yokes and particularly in centers and has for an object to provide a novel construction of neck-yoke center which will possess the maximum strength as well as be flexible in all directions. The neck yoke center is made of harness and sole leather.

WATCH PROTECTOR.—B. Greenberg, Philadelphia, Pa. An object of this inventor is to provide a watch protector for convenient and secure attachment to the pocket of a vest or other garment and arranged to permit the wearer of the garment to conveniently place the watch in position in the protector or remove it therefrom and to prevent abstraction of the watch by pickpockets or unauthorized persons.

FOLDING BOX.—F. G. Fischer, New Haven, Conn. The improvement provides a box having an inner compartment excluding dampness from the box; provides a box the outer wall of which is so constructed as to form no visible joint; provides a construction wherein both the inner and outer walls of the box are provided with openings which aline; and provide a construction having a hinged cover having the four structural sides firmly secured to form a rigid structure.

PIANO VIOLIN.—L. Breitenmoser, Napoleonville, La. The invention is an improvement in violin pianos and the purpose is the provision of an instrument consisting of strings arranged and tuned like the strings of a piano and vibrated by a rubber instead of a hammer and when the resulting tone will approach that of a violin.

MOLD FOR CEMENT BLOCKS AND WALLS.—C. A. Torrance, Gibbon, Neb. Mr. Torrance's invention is an improved collapsible core for use in molding hollow cement blocks and building blocks. In building a hollow cement wall or in forming a hollow cement building block the body of the mold employed being placed in position, the collapsible core is then adjusted in place in the center of the same, its sides opened or distended and by the aid of other means provided a hollow wall may be built up to any required height.

Hardware and Tools.

SAFETY RAZOR.—I. Nahemow, New York, N. Y. By this invention the cutting edges of the blade are retained close to the guard plate at all times during the use of the razor and each guard or guard plate is made as a separate section with means to spread the sections apart or move them together according to whether a close shave or otherwise is desired.

CLOSURE REMOVER.—F. Martin, Sr., Sherrill, N. Y. The invention has for its object to provide for a device for removing the covers of fruit jars and the like, without fear of damaging the jar or injuring the hands. It can be quickly affixed to a jar and by slightly pressing downwardly on the handle of the implement the cover is loosened and raised from the jar.

COMBINATION LOCK.—S. N. Friedman, New York, N. Y. This is a keyless lock having a simple combination which must be known before the lock can be opened. An object here is to provide a lock with a push button attachment by means of which an electric bell or annunciator may be rung and to provide an arrangement whereby the electric bell may be rung if the knob of the box is tampered with.

BIT BRACE.—C. R. Corsino, Crescent City, Cal. The objects of the present invention are: To provide an implement which quickly and easily may be converted from a carpenter's brace for use with a bit to a gear driven breast drill, and to simplify the construction so that the disadjustment of the parts is minimized.

MOUNTING FOR CASTER WHEELS.—J. Sharon, Canaseraga, N. Y. This inventor provides a mounting which may be placed in an operative and inoperative position successively and held in each position securely; provides a mounting which may be quickly and readily adjusted to form a solid bearing for the caster, and provides a mounting durable and of economical construction.

HORSE-COLLAR FASTENER.—A. J. Dains, Pratts Fork, Ohio. The aim in this instance is to provide a fastener by means of which the collar can be expeditiously secured in position upon the animal and be easily released to permit the removal of the collar, without a loss of time, and labor, and in which the parts are securely held together when joined against accidental release.

HAND-TRUCK.—T. C. Fannsbickers, Astoria, Ore. This invention provides a braking device for hand trucks which will automatically operate on downwardly inclined surfaces, automatic devices for hand trucks which are graduated in their operation in conformity with the position of the body of the truck relative to the ground, and to simplify and economize the construction of the truck.

Heating and Lighting.

SUCTION-NOZZLE FOR DUST AND ASH REMOVING DEVICES.—E. Pannenborg, Syracuse, N. Y. The purpose of this inventor is to provide a dust and ashes suction nozzle and its combination with air exhausting means, which enable the speedy and thorough removal of fine ashes from the ash pit of a furnace or the like, and the transfer of such material to a point of discharge.

MEANS FOR FACILITATING THE REMOVAL OF ACCUMULATIONS IN THE PIPES AND ELBOWS OF FURNACES.—E. Pannenborg, Syracuse, N. Y. The intention in this case is to provide openings in the hot air conveying pipes and draft pipes of hot-air furnaces, and novel means for closing such openings so as to prevent leakage, and further to provide similar openings and closures for the elbows of the draft and hot-air pipes for air heating furnaces.

MINER'S CANDLESTICK.—A. R. Sharp, Boise, Idaho. The purpose here is to provide a candlestick which can be suspended from a suitable support which can be driven into a wall or the like to hold it rigidly in place which has means for securely holding the candle, and the parts which are removably held together to permit the candlestick to be taken apart.

CHIMNEY.—J. D. Warren, New York, N. Y. The invention refers to chimneys adapted for use with liquid or gaseous fuel burners and more particularly to chimneys for gas burners with which incandescent mantles are employed. The object is to reinforce and strengthen the base portion of the chimney and provide means whereby air may gain access to the interior thereof to support combustion.

Household Utilities.

BOOK RACK.—E. Oldenbusch, New York, N. Y. In its preferred form the improved rack has two separate end plates foldable into engagement with the base, and this base is formed of telescoping members relatively movable to vary the total length of the rack. The object is to render the rack simple and durable in form and approximately all of the parts of sheet metal.

MATTRESS.—A. T. Quick, Lynchburg, Va. This ventilating device for use in mattresses comprises a tube provided near one end with a circumferential series of openings, a button having a channel receiving such end of the tube, and also provided with inner and outer spurs bent from the inner and outer sides of the tubes through the openings therein and a gauze cover within the ring and held by the spurs thereof.

FASTENING DEVICE.—Mary O'Donovan, New York, N. Y. The device is more especially designed for use on ironing boards to permit the user to conveniently and quickly fasten the cloth cover in place on the ironing board or to remove the same from the board for cleaning, renewal or other purpose, the device permitting the user to properly stretch the cloth cover and to hold it in a stretched position.

BED RAIL FASTENER.—F. W. Merriweather, Kansas City, Mo. Generally speaking this invention consists of a rail having a head secured thereon, a bolt secured in the head, said bolt being adapted to engage a slot or socket in the end of the bed and a wedge adapted to cause the bolt to secure the rail and the end tightly together.

Machines and Mechanical Devices.

ROLLER BEARING.—J. Rambert, San Mateo, Cal. The invention relates more particularly to that type of bearing in which are provided two bearing members or racings separated by a plurality of rotatable load supporting members, and in which those members are spaced apart by intermediate rotatable spacing members. Means provide whereby the rotatable spacing members will have rolling rather than sliding engagement with every part with which they connect.

ROAD-GRADING MACHINE.—B. Whittemore, Albert Lea, Minn. The object here is to produce an implement which is simple and can be readily operated so as to grade a road. The general structure is such that the material of the road bed is scraped from the sides and brought inwardly to the middle portion or crown of the road. Means provide particularly for adjusting the parts and controlling the distribution of the road material.

EXPOSURE ATTACHMENT FOR PHOTOGRAPHIC-PRINTING MACHINES.—E. N. Kuhn, Rock Island, Ill. The machine enables the operator to adjust the time of exposure, incidental to the photographic printing with a high degree of accuracy. It automatically cuts off the light and thus ends the exposure of the paper or other article being printed.

PACKAGING-MACHINE.—R. Hoyt, New York, N. Y. The invention refers to machines for packaging more or less finely divided materials, its principal object being to provide such an apparatus in which the operations of forming an envelop or wrapper, supplying the contents, and closing and delivering the package are continuously and automatically carried out.

GAGE FOR SEWING-MACHINES.—J. L. Kleinman, New York, N. Y. The object of this inventor is to provide a gage for use on the presser foot of a sewing-machine, and arranged to insure accurate guiding of the fabric material with a view to locate the row of stitches the desired distance from the edge of the fabric material or parallel to a previous row of stitches.

PUMP.—T. J. Johnson, Norman, Okla. In operation the straight arms move the pistons in the cylinders, and the weights on the respective sides of the frame are so proportioned, that when one side moves downward, its weight of water serves as power to lift the water on the other side.

WATER MOTOR.—C. A. Whelan, Buena Vista, Colo. The casing of this device with the rotor in place, is arranged in the current, or the path of the movement of the waves, with the inlet end up stream. The water flowing strikes the blades, and since they are arranged at an angle to the lines of force exerted by the current, they are deflected to one side, thus imparting a rotation to the casing, which movement is transmitted by the shaft to the mechanism to be operated.

POCKET CASH REGISTER.—K. Schaub, Kansas City, Mo. In carrying out this invention Mr. Schaub provides a number of wheels, upon the margin of which are certain figures representing monetary values. These wheels are operated by means of a series of rods or plungers and when so operated are turned to register the amounts expended, such registerings appearing in openings in the casing of the device.

SAWMILL SET WORKS.—E. Johnson, Potlatch, Idaho. The object here is to provide improvements whereby the operator is permitted to automatically control the head block knees wholly independent of the main set mechanism and with a view to move the head block knees toward or from the saw and to stop the knees accurately in the desired position.

CONTROLLING DEVICE.—R. V. Inglish, Alpena, Mich. This invention relates to pulp or paper machines, and the object is to provide a device for use in controlling the flow of pulp into the paper machine with a view to supply the latter with the proper amount of pulp for the correct working of the machine and to insure a steady flow of the pulp without danger of clogging.

APPARATUS FOR REMOVING SAND AND OTHER FINE PARTICLES FROM COTTON OR OTHER MATERIALS.—F. B. Cumiston, Dallas, Texas. In the present patent the invention is an improvement in apparatus for use in removing sand or other fine particles from cotton or other material by air suction, and has in view an effective means to separate the particles from the inflowing current of air before the latter reaches the suction fan or air pump.

PRINTING RACK BED MOVEMENT.—C. Harris, Plainfield, N. J. One of the objects in this improvement is to provide a device in which the reciprocating movement is effected by a driving gear which is located on a stationary shaft and which is rigidly secured thereto, the mechanism having far greater durability than in similar devices in which the driving gears are shifted with respect to the shaft.

Prime Movers and Their Accessories.

STEAM TRAP.—G. Kriebling, Scranton, and J. D. Brown, Dunmore, Pa. The invention relates to traps which are adapted to be introduced into steam distribution systems, for the purpose of collecting the condensed steam and discharging the water when a sufficient amount has been collected. An object is to provide a steam trap capable of forcing the water to an elevated position.

FRAMEWORK FOR TURBINES AND GENERATORS.—J. P. Nickosow, Evansville, Ind. The invention pertains to generators and to turbines for driving the same, the more particular purpose being to provide a suitable framework by aid of which the turbine, the generator and various parts associated with the same, are readily combined into a single machine of compact form.

IGNITER.—O. Pearson, Worcester, Mass. In this engine the crude ore or other fuel is delivered directly to its interior and is vaporized by the heat remaining from the last prior explosion. Fuel is admitted simultaneously with the air, and the liquid strikes upon a heated baffle plate below the inlet plate. To facilitate the latter's heating and to avoid interference with the working of the valves, the plate is supported preferably upon the igniter.

Railways and Their Accessories.

CAR FENDER.—J. L. Smith, Rockville, Conn. The object of this inventor is to provide a car fender more especially designed for use on street cars and arranged to run very close to the rails, with a view to rapidly pick up persons or other obstacles in the path of the car. [illegible]

cross bar mounted on the car, and its front is provided with inclined guiding and supporting wheels engaging the inner side of the rails.

PASSENGER STRAP-HANGER.—W. B. McCarthy, Milford, Conn. To overcome many objections, the hanger is constructed of non-absorbent material, as metal, the same embodying a bar body having one or more advertising faces and provided with detachable end members, one of which is provided with suspending means and the other with a hand hold. A bar having one advertisement may be substituted for another, without discarding the entire hanger.

RAILOGRAPH.—J. H. Milligan, Baltimore, Md. The invention is in the nature of a pantograph adapted for application to the heads of railroad rails for ascertaining and recording their transverse contour or form upon a suitable scribing surface. This is performed by railroad companies at regular periods for the purpose of finding the wear and distortion of rails, and more particularly the heads and upper portions of the webs thereof.

CAR SEAL.—E. G. Gebauer, Chicago, Ill. The improvement refers to a seal to be used to secure the doors of a railway freight car or the like, so that they may not be opened without becoming known. The aim is to provide a device cheaply manufactured and which may serve as a sure preventive of tampering without detection.

AUXILIARY CAR STEP.—W. O. Daly, Mobile, Ala. In the present patent the object of the inventor is the provision of an auxiliary car step which when not in use will be folded neatly and inconspicuously against the bottom of the fixed steps and which may be easily moved into operative position from the platform of the car.

MAIL-BAG CATCHER AND DELIVERER.—C. H. Anthony, St. James, Mo. The purpose here is to provide a device which will operate so as to take mail from a passing train, and deliver a bag of mail to the train simultaneously. The construction is such as to facilitate the delivering or catching of more than one bag of mail if desired.

SLIDING DOOR ASH PAN.—H. Alaman and W. McC. Lindley, Terre Haute, Ind. The improvement is in sliding door ash pans. The object of the invention is the provision of an ash pan especially adapted for use with locomotives, wherein the doors are slidably mounted and movable in the same horizontal plane, and operated in unison by a common operating means.

Pertaining to Recreation.

AMUSEMENT FLYING MACHINE.—R. G. Dresslick, New York, N. Y. The invention is of that type in which a suitable machine containing pleasure seekers is traversed between a starting and a receiving station, being suspended by its own sustaining power intermediate the stations. The machine may be reversed. It may be given an upward throw as it leaves the starting rail. It is provided with means to traverse between a starting and a receiving station in either direction.

FISHING APPARATUS.—C. G. Jorgensen, Chicago, Ill. This invention pertains to fishing and trapping and provides an apparatus for use in rowboats, rafts, power boats and the like, and arranged to provide a means for suspending one or more fishing lines in the water at a safe striking distance from the boat and without unduly obstructing the interior of the boat.

GAME-COUNTER.—A. McKinney, Alpine, Texas. The intention in this instance is to provide a device for use in scoring the points as they are made and to keep a register of the number of games played, the returning of the counters proper to their original position after each game operating the game recording mechanism.

AMUSEMENT DEVICE.—G. A. Rosquist, New York, N. Y. The special purpose here is to so mount the cars or seats in respect to their axes, that they may have not only a rotating but a radial movement. The latter may be brought about by special mechanical means but preferably upon centrifugal force. The speed and time of radial movement are preferably controlled by varying the angle of the axis about which the car rotates, in respect to the main central axis.

Pertaining to Vehicles.

VEHICLE-TIRE.—W. W. Scott, Hampton, Va. This invention refers to tires for emergency purposes. An object is to provide a tire which may be carried with the vehicle, and which may be slipped on in lieu of a damaged tire, so that the vehicle may be drawn back to the place where the damaged tire may be repaired.

Designs.

DESIGN FOR A TRIMMING.—D. F. Weil, New York, N. Y. In this case the strip of trimming comprises an ornamental design wherein the chief figure represents dominos stretched in oblique directions along the strip and between the spaces three stars are clustered in a triangle form.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th, 1909, or will be sent by mail on request.

(12219) C. F. L. says: 1. It is stated in textbooks of physics that of two colliding inelastic balls of masses m_1 and m_2 and velocities of v_1 and v_2 the velocity of their common mass after colliding will be represented by

$$V \text{ (common velocity)} = \frac{m_1 v_1 + m_2 v_2}{(m_1 + m_2)}$$

But the equation

$$(m_1 + m_2) v^2 = m_1 v_1^2 + m_2 v_2^2$$

does not hold in most cases upon giving the quantities m_1, v_1, etc., numerical values. In other words, there appears sometimes to be a gain of kinetic energy, which is contrary to the law of conservation of energy. It is asserted that if you transfer the momentum of a ball, weighing say 100 g. to a ball weighing 200 g. the heavier ball's velocity will be half that of the lighter, the momentum of each being the same. But their kinetic energies will not be the same, for (supposing velocity light ball 10 cm. sec.) $100 \times (10)^2$ does not equal $200 \times (5)^2$, but is just twice as great. A. You do not give your address, which is very essential according to the rules of our Notes and Queries column. Your queries would also come within what might be called "an examination paper." Fortunately your queries happen to be more or less of interest generally, therefore we have taken the trouble to answer the same. We wish correspondents to understand, however, that we will not make a practice of answering miscellaneous queries of this nature which do not appear to be practical to themselves. It required over two hours to answer this query, and those who wish answers of this kind should expect to pay at least $4 for the same. Here follows the answer: When two bodies collide and after collision move on together their velocity after collision is determined as you state. It is a matter of momentum. The kinetic energy is a matter of mass and velocity and varies as the square of the velocity. It will be affected more by the change of velocity than the momentum is. 2. It is claimed that the vapor tension from a concave surface of a liquid is less than from a plane surface, and that this is in some way connected with the phenomena of cohesion. Kindly explain. A. We cannot discuss the relation of shape of the surface of a liquid to its vapor pressure, as we have not followed out any experimental work in that line, and would suggest that you take up the matter with the original investigators, whose opinion would be of value. 3. Why is the melting point of ice lowered by pressure? A. All liquids which expand upon freezing may be melted by compressing them in the solid condition into the volume which they had before they solidified. Liquids which contract upon freezing cannot be melted by compression, since this only brings the molecules still nearer together. To melt them they should be expanded. If a liquid which expands upon freezing is prevented from expanding it cannot freeze, since its molecules cannot move any farther apart, as they must do to turn into the solid form. 4. What are the properties of gas as liquid at the critical point as regards density, latent heat of vaporization, etc.? A. We are not able to find any figures as to the heat of vaporization for any substance at the critical temperature. The liquid expands as it is heated to the critical point. Its density is therefore diminished, its vapor in the space above the liquid becomes more dense. At the critical point the two meet in density and an insensible change takes place. If more heat is applied the liquid disappears and the whole becomes a vapor. Duff, Physics, page 245, says: "It is idle to ask if the homogeneous fluid is a liquid or a gas. . . . The continuity of the inclosed mass has never been broken. We can distinguish the two states only when the temperature is below the critical." You may find the density for several substances at the critical points given in the Smithsonian Physical Tables, page 200. 5. Is the phenomenon of a gas escaping through a small hole without friction to be regarded as a molar or molecular phenomenon? A. If the opening through which a gas is escaping is larger than a molecule, the escape of the gas is a phenomenon of a mass. 6. What is meant by the word entropy? A. In the Century Dictionary you may find the following definitions of Entropy: "As used by Clausius, the inventor of the word, and others, it is that part of the energy of a system which cannot be converted into mechanical work without communication of heat to some other body or change of volume. As used by Tait and others, it is the available energy, or that part of the energy which is not included in the first definition." Clerk Maxwell defines as follows: "The entropy of a system is the mechanical work it can perform without communication of heat or alteration of its total volume, all transference of heat being performed by reversible engines." For fuller definition see Watson's Physics, pp. 339-345. Price $1. 7. Would it be possible to hold a copper or silver coin suspended in air by means of a powerful magnet by virtue of eddy currents? A. Copper and silver are not attracted by a magnet in the slightest degree. 8. Why does the heat of vaporization increase as the temperature of the evaporation liquid is lowered? A. We are not able to explain why the heat of evaporation increases as the temperature of a liquid is lowered, unless it is due to the fact that the liquid is further from its vapor condition at the lower temperature. 9. What is the best way to make a glass vessel chemically clean? A. Glass is cleaned by the action of nitric acid, potash and distilled water in succession.

(12220) T. H. calls our attention to an error which he made in Query 12217 in using the radius of the moon's orbit where he should have used the diameter as a basis of his calculation. This is true. We did not notice his error in reading his letter, probably because we did not suppose any one would make such a mistake. If this correction is made the orbit of the moon becomes twice as long and the rest of the calculations can be corrected accordingly.

NEW BOOKS, ETC.

Financial Advertising. For Commercial and Savings Banks, Trust, Title Insurance, and Safe Deposit Companies, Investment Houses. By E. St. Elmo Lewis. Indianapolis: Levey Brothers. Pp. 992.

Mr. Lewis is peculiarly competent to write a book upon advertising for the simple reason that the better part of his life has been identified with advertising and particularly with the advertising of a certain adding machine which is much used in banking institutions. The work before us represents the fruits of wide experience in what the author calls "financial advertising," and contains a fund of information which may well be applied to other kinds of publicity. Beginning with a brief history of advertising, in which the town crier and the auctioneer and what might be called primitive advertising come in for their share of comment, the author plunges into a second chapter on the banker's duty to the public, a subject which may apparently have very little to do with advertising to the casual reader, but which has a direct bearing upon banking publicity because of the intimate relation of banking to the people. Of wider use, perhaps, and therefore more valuable to the advertiser, is the chapter on "How to Reach the People." Here indeed Mr. Lewis is in his element, for he gives many an excellent concrete example of what good advertising means, how it is conceived, and how a scheme is carried out. The essentials of good advertising are discussed under the various headings of "Attracting the Attention," "Awakening the Interest," and "Creating Conviction," all of them decidedly essential, as every modern advertiser knows. The relative values of local newspapers, magazines, street car advertising, advertising novelties, booklets, folders, house organs, circular and form letters, etc., are thoroughly compared. We would comment particularly on Mr. Lewis's book as to its essentially practical character. He even discusses the value of printing, the advertising manager and his work, the function of the publicity promoter, and the peculiarly special problems which confront savings banks, trust companies and stock brokers.

Broad Lines in Science Teaching. Edited by F. Hodson. With an Introduction by M. E. Sadler. New York: The Macmillan Company, 1910. 267 pp. Price, $1.25.

If anyone needed evidence of the many-sided view of science in modern education he would surely find it in this admirable collection of essays edited by Drs. F. Hodson and M. E. Sadler. In furtherance of the Editor's object to achieve through a variety of essays an adequate notion of the requirements which in the ideal case should be satisfied for boys in secondary schools, the various essayists who have contributed to this volume have carefully examined the claims of rival departments of scientific study and the various methods of teaching. The essays of which the book is comprised are the following: The Place of Science in the School Curriculum, The Scope of Nature-Study, The Teaching of Nature-Study, Biology in Schools, The Teaching of Hygiene, The Place of Hypotheses in Science Teaching, The Claims of "Research" Work and Examinations, School Mathematics in Relation to School Science, Co-ordination of Physics Teaching in School and College with Special Reference to Electricity and Magnetism, Geography, Science in the Teaching of History, Economic Science in Secondary Schools, Domestic Science, The Teaching of Chemistry in Technical Schools, How the School May Help Agriculture, Engineering Science Teaching and the Training of the Affections, Science Teaching and a Child's Philosophy, The Present Condition of Physics Teaching in the United States, School Science in Germany, Some Practical Notes on the Planning of Science Laboratories.

The Prolongation of Life. Optimistic Studies. By Elie Metchnikoff. New York: G. P. Putnam's Sons, 1910. 343 pp. Price, $1.75 net.

Prof. Metchnikoff has been very much in the public eye of late years because of his bacteriological investigations of senility. As a result of his widespread teaching that the comparative shortness of human life is to be attributed largely to the enormous length of the human intestines and the putrefaction of food therein, the fermented milk industries have received a new impetus, for in the bacteria of fermented milk Prof. Metchnikoff finds those counteracting agents which stop putrefaction and thus lengthen human life. The theories advanced in the present volume do not differ from those advanced in his previous volume on the same subject. Metchnikoff offers for the treatment of old age a method of nutrition which he believes will diminish the danger to old persons from being attacked by those diseases to which they are especially liable. The book, however, is more than this. To a certain extent it presents Metchnikoff's views as to the conditions of life and the objects of existence. It is not a perfectly reasoned out philosophy, nor is it based upon anything but purely physiological research. Yet it is a very real and very important contribution. The book is divided into the following parts: The Investigation of Old Age, Longevity in the Animal Kingdom, Investigations of Natural Death, Should We Try to Prolong Human Life? Psychical Rudiments in Man, Some Points in the History of Social Animals, Pessimism and Optimism, Goethe and Faust, Science and Morality. After reading this book one feels that cheerful optimism is one of Metchnikoff's temperamental qualities.

Three Rivers. The Hudson, The Potomac, The James. A Retrospect of Peace and War. By General Joseph P. Farley, U. S. A. New York and Washington: The Neale Publishing Company, 1910. Illustrated with ten sketches from nature by the author in water colors, reproduced in color. 8vo., cloth, handsome letterpress and binding. 277 pp. Price, $2 net.

The author of this work, who, though a Southern man by birth and affiliation, fought for the Union in the civil war, is known throughout the world as an ordnance expert, and he was one of the designers and constructors of the army 16-inch rifle, the largest type of gun extant to-day. After more than half a century of service in the army he writes this delightful retrospect of peace and war, a record in which anecdote, history, biography, observation, and experience—books, battles, soldiers, pictures, theories, men and things—are happily mingled. He has selected for his memory pictures the three rivers more intimately connected with his life. Along the banks of the James he recalls his boyhood and early manhood, many battles of his fighting days, and the contest of the ironclads in Hampton Roads. On the Potomac he recalls many famous homes of famous families, and recounts the inner history of such battles as Bull Run, Malvern Hill and Gettysburg. Finally he describes the old and the new West Point of the Hudson, this part of the book being replete with interesting biographical sketches relating to that historic center.

Schley, Sampson and Cervera. By James Parker, formerly Lieutenant Commander, U. S. N. New York and Washington: The Neale Publishing Company, 1910. 344 pp., 9 illustrations. Price, $2.

This work, which is a review of the naval campaign of 1898 in pursuit and destruction of the Spanish fleet commanded by Rear Admiral Pascual Cervera, is a contribution to the literature of the famous Sampson-Schley controversy. But it is much more than that, inasmuch as the author gives a very complete and consecutive account of the various naval activities, both in Washington and on the high seas, connected with the memorable Spanish war. While the author admits that it will be evident to the reader that his professional, legal, naval and personal judgments are favorable to Admiral Schley, he has made it his aim to do full justice to every other officer concerned, being prompted to this by the fact that he still regards them as his professional brethren. He states that the book has been written without any consultation with Admiral Schley, who has never seen a line of it, and does not know that it has been written. The work is published in the hope that a careful reading of the review will dispel all misunderstanding of that campaign, a misunderstanding which has pertinaciously been promulgated in the effort to convey false impressions with regard to the principal actors in it. The work is so written that it should certainly put the reader in a position to judge for himself of the actual merit of the campaign. It is to be hoped, however, that with the publication of this work we have heard the last of this unfortunate controversy.

Die Heissdampf-Schiffsmaschine. Eine Sammlung von Erfahrungsangaben für die Berechnung der Abmessungen und des Dampfverbrauches, sowie des Kohlenverbrauches der Schiffmaschinen für Heissdampfbetrieb. Von Carl Fred Holmboe. Berlin: Wilhelm Ernst & Sohn, 1910. Price, $1.50.

Stenographer and Employer. By Fessenden N. Chase. Portland, Me.: Press of Southworth Printing Company, 1909. 86 pp. Price, $1.

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Funnel, measuring, J. B. Romero ... 954,348
Furnace for heating metal bars, W. J. Mack ... 954,322

How Railway Traffic is Managed.

BY C. C. RICE.

Almost everybody knows something about railroad rules, but very few, unless holding or having held some railroad position, have a clear idea of just how many precautions are taken to prevent accident.

Whenever a big wreck occurs, through error in train orders, oversight of a telegraph operator, engineer, conductor, or flagman, the newspapers usually give one cause and blame one person, when more than likely two or three are equally to blame.

The rules of course vary to some extent on the different systems, but those explained in this article are near enough standard to give the reader a clear insight into just how many things must go wrong before a collision can occur. The road in mind has part single and part double track, uses the telegraphic block system on the single track and automatic electric block on the double track. The rule book, which is the railroad man's Bible, is a little book not much larger than a post card, one-quarter inch thick, and contains only 120 pages. All changes and special instructions are issued in the employees' time table, which contains the schedule time of every train at all stations. This time table divides the trains into four classes, passenger trains being first class, time freights second class, and so on. It also gives east bound trains right over west-bound trains of the same or an inferior class, so an east bound first-class train has right over all trains and pays no attention to any schedule but its own, while a west-bound first-class train is superior to everything except a first-class train east-bound, but has to take care not to encroach on the schedule time of any first-class east-bound train. A poor fourth-class train west-bound is inferior to everything, and when on consulting his watch and time table the conductor finds some higher class train nearly due, it has to dodge into a side track, allowing a first or second-class train to run ahead, or to meet a first, second, third, or fourth-class train. Now, if trains never got late, watches never went wrong, or train crews never looked at their own or other schedules wrong, trains could move along just on their time-table rights as their schedules are so figured that they meet, pass, and are passed at certain stations and certain times. But some things will go wrong. So as an additional precaution the dispatcher issues train orders telling them where to meet and pass, giving inferior trains orders that some superior train is running late, where to run slow on account of bad track reported by track walkers, and in every way trying to save delay and insure safety.

These train orders are sent to all trains and stations concerned at the same time, and are not delivered to any train until all copies have been correctly repeated. When a train order increases the time-table rights of a train, it may be handed up to the moving train, but when it restricts these rights, the train crew has to stop and sign for the order. The telegraph operator is required to set all block and train-order signals at danger, and so notify the dispatcher before he copies a train order, and must not change these signals until the order is delivered, or if the order is for trains to meet at his station, his danger signal must remain displayed until the meet has been accomplished.

In addition to running by train orders and schedule, a block system is operated independently. At every station is one tall pole, called a semaphore, on which signals are displayed. The space between two of these semaphores, usually three or four miles, is called a "block." Now, under absolute block rules, no two trains can occupy the same block at one time. The block signals on the semaphores stand at danger all the time, and are never clear except when held in this position by the operator. A train before

proceeding is required to see this signal change from danger to clear

At all stations a record is kept showing the departing time of every train at this station and at the next station east and west. Supposing a west-bound train to be approaching a station semaphore The telegraph operator, if he has no orders on hand for this train to meet anything at his station, consults his block record, and if the block west is clear he calls up the station west, and obtains permission to let a train in the block He then pulls his block signal clear and holds it in this position until the train is by, immediately reporting it to both block stations and the dispatcher

If a train from any cause has to stop between stations or finds itself on the schedule time of a superior train it has to flag, putting down torpedoes and sending a man with a red flag ahead and back notwithstanding the knowledge that the telegraph operator will not let another train enter the block until it is clear

Now, on double track things are very much simplified, as all trains going in one direction move on the same track, and only have to take siding to allow a train of higher class to run ahead. This allows the use of automatic electric block signals placed at intervals of about a mile, all signals being on the right hand side of the track which they govern At every one of these signals the joints between the rails are insulated, thus cutting the tracks up into blocks between the signals These signals are so wired that when a train approaches one of them, if the block ahead is clear, the circuit will be completed from one rail to the rail on opposite side of track through the wheels of the train, causing the signal to come clear, in which position it stands until the engine passes it If one of these signals fails, the train is required to wait a minute or two long enough to allow a preceding train to clear the block or to flag, and then proceed with caution to the next signal, reporting the failure at first office

These automatic signals work over two thousand times to one failure, and are so constructed that a failure leaves the signal at the danger position

Estimation of the Working Capacity of a Man Before and After an Accident.

The problem of determining the working capacity of the victim of an accident is divided into two parts It is necessary to establish, first, the condition in which the accident has left the various organs and functions of the body, and secondly, the effects of the consequences of the accident upon the power to work, either at the victim's previous occupation, if he is able to continue it, or at such other occupations as he may be able to carry on Dr Imbert in a recent article criticises the methods generally employed for the solution of this problem The attendant physicians and the medical experts give only their personal opinions, instead of employing the exact methods of examination which are used in physiological laboratories. Thus in many cases, in which the statements of the victim appear false or exaggerated, the truth could easily be ascertained by the use of X rays or by the electric exploration of the nerves and muscles Dr Imbert describes various researches which he has made in the physiological study of certain occupations. He thinks that it is possible to arrange a mass of useful data in a form in which they would be available for the decision of individual cases.

That apparently most remote of the sciences from the exactness of physical laws, economics, has been brought under the treatment of mathematics, not only by statistical methods, but by methods of the calculus. The distinguished mathematician and economist Cournot applied to the theory of wealth methods like those used in mechanics to treat of equilibria, so that very complicated economic principles were amenable to treatment by symbols.

Furnace regulator O F Lawrence . 954 086
Fusees, compound for railway signal I Nitch 954 330
Galoshes, etc device for drawing on and drawing off F von Taxis 954 061
Game apparatus, R H Zschau 954 070
Game device E L Ellis 953 908
Garment R P Prendergast 954 132
Garment rack G M Vail 954 161
Garment supporter W P Kellogg 953 857
Gas feeding and mixing device F E Dillon 953 830
Gas generator G A Heckert 954 099
Gas generator acetylene G F Johnson 953 840
Gas ignition and control automatic I G Bartlett 953 985
Gas meter dry T R Wylie 954 230
Gate operating mechanism, tilting F A Guth 954 290
Gear casing, R R Mason 954 038
Gear casing R A Palmer 954 100
Gearing A F Clarke 954 160
Gearing reversible transmission M W Kouns 953 848
Gearing reversing F R Palm Jr 953 704
Gearing transmission W Pilbeth 953 902
Gearing transmission W W Henderson 954 286
Glass drawing mechanism sheet J Player 953 971
Golf ball trap for golf putting practice C W Johnson 954 290
Governor for explosive engines automatic fuel cut off J I Wood 954 155
Grader road A Gauser 954 390
Grain drier L S Kiser 954 053
Grain drill J F Steward 953 992
Granary portable W J Haas 953 8,7
Grinder feed J F Lappen 954 114
Grinding machine C W Romar 954 134
Gripper F A Stiggins 954 008
Gun muffler G F Childress 953 941
Hammer power F F Sutherland 953 708
Hand or tool holding attachment for amputated arms artificial D W Torrance 953 821
Hanger See Cable hanger
Harrow drag and pulverizer W B Mitchell 953 702
Harrowing of the ground mechanism to lift the drags during the W von Tecklenburg 953,700 954,394
Harvester R Holt 954 080
Harvesting machine cutter J H Wilson 954 078
Hat fastener R Dalsoul
Hat pins etc safety attachment for G Hofmann 954 297
Heald shaft for wire and metal healds, H R Barlow 954 011
Hides skins or leather machine for treating W A Wust 953 857
Hoist fluid actuated balanced G F Steedman 954 401
Hoisting apparatus multiple A M Coyle 954 022
Hoisting bucket bottom dumping A N Dodd 954 266
Hoople G Chambers 953 818
Horseshoes apparatus for manufacturing E Eckersen 953 760
Hose coupling F G Schaefer 954 348
Humidor L Kahn 953 841
Hydrocarbon burner S L Davis 954 480
Hydrocarbon furnace A O Bradford 953 665
Ice cream cone dipper A J Dankel 953 901
Ice cream freezer G W Pallion 954 411
Ignition apparatus E Eiseman 953 900
Ignition trouble finder F T Cable 953 770
Index or directory D T O Sullivan 954 334
Indicator H A Raeicker 953 762
Indicator F Pearson 954 128
Induction motor R B Williamson 953 809
Ingots and other castings apparatus for making metal R A Hadfield 954 188
Inkstand C C Miles 953 917
Insulator A T Siler 954 130
Insulator protecting apparatus I C Nicholson 954 839
Internal combustion engine F C Richard 954 208
Invalid raising and moving device C W Lane 953 182
Ironing board T A Davis 954 201
Ironing board F A Shampine 954 140
Irrigation system Sweeney & Kennedy 954 050
Keg rinser A C La Budde 954 307
Key extracting device A F Rowe 953 928
Kiln F Anderson 954 213
Knitting machine needle J C Early 954 174
Labeling machine can end I W Earl 953 044
Lamp electric arc J Rigdon 953 860
Lamp gas F J Humphrey 953 835 953 830
Lamp gasolene A R Lee 953 911
Lamp shade A H Hong 953 950
Lamp socket incandescent electric J K Lux 954 117
Lamp vapor M Calvao 953 900
Lamps lock guard for incandescent H Hubbell 953 814
Lamps vaporizing and igniting means for hydrocarbon Y Kawasaki 953 748
Land roller F S Wilder 953 771
Lantern reflecting N H Brown 954 400
Lasting machine T H Stamm 954 765
Latch door W A Mooney 954 124
Latch gate I Cosgrove 953 909
Launching apparatus C Hunt 953 004
Lawn trimmer A C Warner 953 870
Leather finishing machine variable speed roll W R Smith 953 080
Lens attachment F I Williams 953 870
Letter case label for postal cars H C Hoffner 953 807
Level spirit Belmer & Burdick 954 074
Line casting machine C D Hartley 954 745
Line check W H Fowler 954 178
Linotype machine J R Rogers 954 704
Loading apparatus J Nichol 954 128
Loading device vehicle R C Miner 954 108
Lock See Door lock
Lock F H Walls 953 874
Lock movements spring box for time C A Miller 954 123
Locomotive ash pan Ennis & Hall 954 274
Locomotives sand distributor for H R Wasson 954 233
Loom needle C A Ewerk 953 770
Loom shedding mechanism A A Gordon Jr 954 181
Loom shuttle changing mechanism O Cosserat 954 779
Loom take up mechanism R F McGuiness 954 127
Looms cloth guiding means for Gustafson & Duquette 953 836
Lumber and veneer drier thin J A McDougall 954 041
Mail box A F Martel 954 027
Mail hook J Hammond 953 820
Manhole cover sewer Rice & Lendergast 953 858
Manicuring instrument G W Moore 954 125
Manifolding device G F Hutchings 954 102
Manure spreader F F Bewley 954 137
Massage apparatus R H Guy 954 063
Mattress F J Hecht 954 284
Measuring device ribbon and cloth H T Quandahl 953 940
Measuring instrument Y R Tucker 953 933
Measuring liquids apparatus for F De Lorenzi 954 202
Meat boning implement H Gellman 954 081
Mechanical movement R Lindner 954 110
Merry go round J D Walsh 954 808
Metal band J A Gray 954 093
Metallic tie and rail fastener W H Chamberlain 954 254
Meter See Dry meter
Milk can, E W Kimball 953 844
Milking vessel support S W Orster 953 994
Milling machine attachment J R French 953 994
Mining drill G W Nixon 953 855 953 980
Mold W M Sheppard 953 12.6
Mold P H Allison 954 408
Mold for collapsible metal centerings E I Sheets 953 925
Molding machine R S Bush 953 904
Mosquito net frame E L Moffitt 953 985
Mowers, grass elevator for horse lawn T Spencer 954 007
Mowing machine M G Otis 953 767
Mowing machine cutter bar Poole & Abbenseller 953 711
Muffler H J Cardie 954 778
Music rack J Sweeney 954 758
Music turner automatic M L W Wilson 954 290
Neckwear F K Blanchard 954 017
Nest, hen's S M Hixson 953 785
Numbering machine B R Conrad 953,819
Nut frictional lock W F Kearney 954 804

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Advertising in this column is [illegible] cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

PATENTS FOR SALE

FOR SALE. U. S. patent automatic time cut off for individual electric lights. Needed wherever electricity is used for lighting. Will submit particulars and samples to those interested. Paul Dixon, 47 Whitehall St., Atlanta, Ga.

Inquiry No. 8918.—For manufacturers of "Wydt's Electro Catalytic Sparking Plug."

HELP WANTED

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres. The Nat'l Co-op. Real Estate Co., Suite 378, Marden Building, Washington, D. C.

Inquiry No. 8987. Wanted the manufacturers of the Van Winkle Woods & Sons and the Weber power meters.

MECHANICAL SUPERINTENDENT to take charge of large machine shop. Apply stating experience and salary expected. Superintendent, Box 773, N. Y.

Inquiry No. 9011. For manufacturers of machinery supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

EXPERIMENTAL ENGINEER wanted by a large manufacturing concern having technical and practical knowledge of mechanics and preferably chemistry as well. Must possess special aptitude for this character of work. Address in confidence with full particulars including salary expected. Business Service Co., 305 Broadway, New York.

Inquiry No. 9016. Wanted machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

LISTS OF MANUFACTURERS

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9017. Wanted to buy silk machines from re-reeling, twisting, doubling to the final process of making it into clothes.

SALE AND EXCHANGE

FOR SALE. Engine lathe. Our regular $75.00 lathe complete, with a face plate, two centers, wrenches and a full set of change gears to cut all size threads. Price only $48.50. L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9020. Wanted catalogues and all information on machinery for braiding straw in manufacturing straw hats.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9038. Wanted the address of the Chipman Electric Purifying Co.

Inquiry No. 9042. Wanted the address of Farney Safety Razor Co.

Inquiry No. 9052.—Wanted address of firms who install plants to manufacture nitrogen.

Inquiry No. 9053. Wanted address of parties interested in Gas Cleaning Machines.

Inquiry No. 9060. Wanted to buy machinery to manufacture seed corn racks.

Inquiry No. 9066. Wanted complete outfit for export for making rice flakes and wheat flakes.

Inquiry No. 9069.—For the address of firm making chain cloth, something like the ladies' purses are made of.

Inquiry No. 9071.—Wanted the address of parties making moulds for large concrete vases for flower pots.

Inquiry No. 9073.—Wanted, machinery to manufacture cocoanut oil; also the crude material.

Inquiry No. 9074. Wanted to buy old model locomotives or steamboats, such as were exhibited with nickel-in-the-slot attachments in ferry houses, etc.

Inquiry No. 9075. Wanted to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

Inquiry No. 9076.—Wanted the address of parties in Canada who could make a safety razor.

Inquiry No. 9077. Wanted the address of manufacturers that make small articles of wood, such as checker boards, etc.

Inquiry No. 9078. Wanted the address of manufacturers of sewer pipe, made of fiber and asphaltum, suitable for laboratory use.

Inquiry No. 9079. Wanted, parties to make a special slot plate rolled for "angle bars" in large quantities.

Inquiry No. 9080. Wanted the address of parties manufacturing paste-making machinery.

Inquiry No. 9083. Wanted the address of firms manufacturing small beer brewing plants, from 25 to 100 gallons a day.

Inquiry No. 9084.—Wanted, the address of manufacturers of Irwin portable bath tubs.

Inquiry No. 9085.—Wanted to buy longitudinal hollow perforated tubing.

Inquiry No. 9086.—Wanted to buy a pine wood peeler.

Inquiry No. 9087. Wanted a machine for hardening hack saw blades; also a machine for setting same when they have been toothed.

Inquiry No. 9090. Wanted manufacturers of stair oiler and supporters supplies, also patent adjustable bachelor buttons.

Inquiry No. 9092. Wanted the address of some firms who manufacture permanent lamp wicks.

Inquiry No. 9091. Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9095.—Wanted, name and address of the manufacturer of the duplex revolving pencil sharpener.

Inquiry No. 9096.—Wanted the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted address of makers of impulse water wheels.

Inquiry No. 9098. Wanted name and address of the manufacturers of the cashier.

Inquiry No. 9099.—Wanted address of manufacturers of machinery for making wire cables.

Inquiry No. 9101. Wanted addresses of manufacturers of a dip or magnetic needle, for exploring for iron ore.

Inquiry No. 9104.—Wanted addresses of manufacturers under the name of A. O. Co. Standard.

Inquiry No. 9106.—Wanted addresses of cotton dealers who can furnish cotton material for manufacturing envelopes.

Inquiry No. 9107.—Wanted addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dim Desk Clock.

Inquiry No. 9110.—Wanted to buy machinery for reducing old tin cans, so that they may become a source of revenue.

Inquiry No. 9112.—Wanted sample small dry vacuum pump about 6-inch diameter cylinder inside, high temperature metal packing.

Inquiry No. 9113.—Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114. Wanted name and address of manufacturer of the Auto Lantern Globe. Fits all lanterns.

Inquiry No. 9115.—Wanted a machine for making pen nibs similar to Wm. Mitchell's G. & J. nibs and Waverly nibs.

Inquiry No. 9117.—Wanted names and address of the manufacturers of pedometers.

Inquiry No. 9118.—Wanted a muffler for a gasoline engine built upon the principle of the Maxim silencer recently brought out for use on rifles.

Inquiry No. 9119. Wanted, name and address of the manufacturer of Beglin bullet proof cloth.

Inquiry No. 9120.—Wanted the address of the Ideal Fuel Feeder Co.

Inquiry No. 9121.—Wanted manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9123.—Wanted, manufacturers of ditching machines used for tiledrains operated by horse power.

Inquiry No. 9124. Wanted name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9125.—Wanted name and address of the Just Hatmaker machine for manufacturing milk powder.

Inquiry No. 9127.—Wanted address of L. Dequigny, manufacturer of a family ice machine for $10.00.

Inquiry No. 9131.—Wanted information as to how or where I could get a sample of tin ore.

Inquiry No. 9132. Wanted, manufacturers of a gasoline traction engine with a hoisting attachment; in other words, the machine will be used as a portable stump puller to pull sassafras roots, used in making oil of sassafras.

Inquiry No. 9133.—Wanted, manufacturers of floss candy machines.

Inquiry No. 9134.—Wanted, a small hydraulic motor capable of giving about one horse power with a water power of 25 lbs. per square inch.

Inquiry No. 9135. Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted the address of manufacturers of machines capable of forming a number (12 or more) of pieces of paste about 20 mm. x 12 mm. x 6 mm. made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 4 mm. The process could be somewhat similar to biscuit making.

Inquiry No. 9139. Wanted the name and address of some manufacturer of a coffee mill run by water motor.

Inquiry No. 9140.—Wanted manufacturers of disc records for gramaphones that use a sapphire point instead of a steel needle.

Inquiry No. 9141.—Wanted a boat like a row-boat, worked by levers in place of oars, which by a series of pulleys attached operates a propeller, the steering device is managed with the feet.

Inquiry No. 9142.—Wanted, an appliance used in ice chests to make ice last longer.

Nut lock, P. A. Alt	954,010
Oil cup, J. I. Doyle	954,174
Oil tank, safety, Weston & Orth	954,152
Ore concentrating and separating apparatus, F. Dallemagne	953,900
Ore concentration, apparatus for, T. J. Hoover	953,740
Ore crushing machinery, E. O. Hutchinson	954,295
Ore separating apparatus, magnetic, Q. Ikut	954,016
Ore separation, magnetic, Q. Ikut	954,015
Ores, treating arsenid, F. P. Dewey, 954,265	954,264
Orthopedic device, L. Roth	954,005
Oven, bakers, J. C. Ferger	954,383
Packing, metallic, W. H. Law	954,105
Packing, metallic, E. Passono	954,203
Packing ring, piston, J. J. Rednor	953,713
Pail, milking, F. H. Newlove	954,129
Paper coating machine, E. Williams	953,728
Paper into strips and printing scales thereon, apparatus for cutting, E. Higner	953,742
Paper making machines, couch roll for, C. H. Smith	954,005
Paper receptacle, C. F. Jenkins, 954,104	954,105
Paper trimmer, Pierce & Colthar	953,866
Paper tubes, apparatus for securing closures in, C. F. Jenkins	954,106
Paring machines, apple, W. R. Phillips	954,140
Pedal action, L. W. Norcross	954,043
Pester, R. Powell	954,047
Pen, H. W. Kueffner	954,306
Pencil sharpener, F. F. Hiner	953,986
Photographic printing apparatus, W. C. Huebner, 954,290, 954,291	954,292
Photometer, candle foot, W. D. Ryan	953,765
Piano action, H. O. Clark	954,170
Piano action, grand, E. Schnabel	954,140
Piano agraffe, R. M. Hutchinson	954,189
Pie tin frame, B. Silfa	954,351
Pinion cutting machine, automatic, A. H. Neuroutner, 953,753	953,752
Pipe. See Smoking pipe.	
Pipe attachment, A. Marr	954,316
Pipe coupling, W. R. Willetts	954,066
Pipe coupling, J. A. Fleming	954,177
Pipe couplings, clamping ring for, W. W. Price	953,780
Pipe threading tools, work holder for, I. W. Nonneman	953,971
Pipes, machine for the manufacture of earthenware, H. Yarrow	953,987
Planer head bits, holding device for, R. D. Stevens	954,146
Planing machines, sectional chip breaker for, W. R. Buss	954,376
Planing machines, work feeding apparatus for wood, C. W. H. Blond	953,814
Planter and fertilizer distributer, J. B. & C. B. Ebling	953,922
Planter marker, L. J. Lindsay	953,949
Planter, seed, I. N. Todd	953,976
Plow, J. W. Stallings	953,987
Plow, double shovel, L. C. Gregory	954,370
Plow frame, W. N. Hiett	953,907
Plow, grubber, V. O. Dayl	[illegible]
Plow, grubbing, C. D. Janer	[illegible]
Plug, detachable, C. D. Platt	[illegible]
Plug, separable attachment, C. D. Platt	953,799
Plunger cables, means for tightening, F. G. Furlow	954,087
Pool table pocket, T. Maroney	953,958
Potato digger, R. W. McKay	953,968
Potato digger, J. M. Fallick	954,084
Potato digger, R. W. McKay	954,042
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Pressing machine, H. Lindestrom	954,314
Printing, A. O. Watkins	954,365
Printing machine, tapestry, G. W. Stokes	953,881
Printing press, S. Crump	954,279
Printing press feed mechanism, J. A. Kacha	953,940
Printing press inking mechanism, S. G. Goss	954,088
Printing press paper roll braking mechanism, S. G. Goss	954,089
Printing press plate clamping mechanism, S. G. Goss, 954,090,	954,091
Printing presses, feeding gage for platen, B. Silfa	953,718
Prints, etc., making fast gray, G. Engi	954,278
Prism, portable, J. R. Kimbell	954,305
Propeller, H. F. Shaw	954,058
Propeller shafts, means for mounting, A. Clement	954,077
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Pulley dressing, Leix & Lowy	953,899
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Pulp stock separator, G. S. Witham, Sr.	954,154
Pump, C. H. Scott	954,051
Pump, self measuring, C. F. Hatmaker	954,097
Pump stand, J. J. Hess	953,830
Pump, terminal suction, C. D. Durkee	954,289
Pump, vacuum membrane, M. Falk	953,049
Pumps, inlet valve and water screen for, O. H. Tillyman	954,213
Puzzle, R. L. Hicks	953,909
Quilling machine attachment, W. B. Lovatt	953,814
Rack. See Garment rack.	
Rail cleaner, J. P. Gorman	954,278
Rail joint, T. L. Humble	953,786
Rail joint, A. G. Broussard	954,251
Rail joint, F. R. Bush	954,347
Rail joint lock, H. L. Mason	954,120
Rail lubricating apparatus, Farley & McDonald	954,383
Rail tie and fastening, W. F. Beck	954,248
Railway rail anchor, D. H. Foreman	954,400
Railway system, electric, B. W. Radius	954,342
Railway tie, G. H. Martin	954,000
Railway tie, H. R. Rice	954,145
Railway tie, metallic, W. J. Allsbrooks	953,904
Railway track construction, J. W. Blower, 954,168	954,249
Razor, safety, T. C. Durham	953,980
Receptacle, J. M. Rau	954,306
Receptacle closures, apparatus for forming and inserting, C. F. Jenkins	954,107
Receptacles, machine for inserting closures in, C. F. Jenkins	954,106
Refrigerating and ice making apparatus, Pfleiderer & Harris	953,972
Regulating device, C. G. Spradis	954,057
Remedy for swine plague, A. Franke	953,047
Removable rim wheel, R. H. Buckingham	954,076
Repair member, J. Heck	954,098
Retoothing machine, J. P. Hedstrom	953,892
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Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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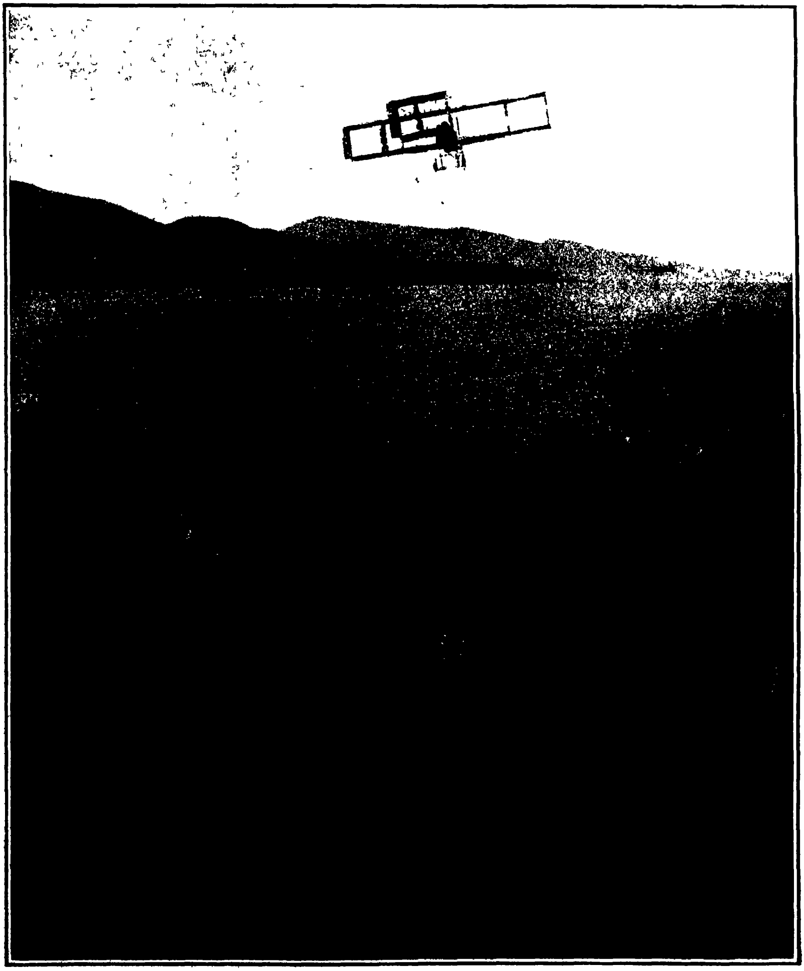

ROUGIER FLYING ACROSS THE BAY OF MONACO IN HIS VOISIN BIPLANE.—[See page 342.]

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NEW YORK SATURDAY, APRIL 23rd, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic the contributions will receive special attention Accepted articles will be paid for at regular space rates

TRUE WAY TO PREVENT RAILWAY ACCIDENTS.

It is well understood among railroad officials that the most fruitful cause of railroad accidents in this country is to be found in the lax sense of discipline among the employees Presumptive proof of this is found in the fact that, although our leading railroads have been equipped with a block signal system and other safety appliances, which are generally equal and in some cases superior to those on European railroads, the number of accidents in proportion to the number of people carried continues *to be larger in this country* We therefore note with much satisfaction that the Chicago and Northwestern Railway has taken a step in the right direction by appointing an *official* whose chief duties will be to make a study of railway accidents, and by a system of education and strict enforcement of discipline, endeavor *to eliminate the most fruitful cause of injuries* to passengers and damages to freight Opportunity was recently taken of the reorganization of the company's claim department, to relieve the claim agent of much of the detail of his work and allow him to make a careful study of the causes of all accidents in the handling of passengers and freight It will be his duty to bring about a more thorough co-operation and a higher state of discipline among the various employees, upon whose fulfillment of their duties the safe operation of the trains immediately depends The scheme is a most excellent one, and we believe that its results will be so satisfactory as to lead to similar arrangements on at least the more important railroads of the country

AN EPOCH-MAKING EXPERIMENT.

At the last meeting of the Institution of Naval Architects, a paper was read by the Hon C A Parsons which created a profound impression among the British naval architects and shipbuilders It was described by Prof J A Ewing of Cambridge University as epoch making", and the announcements which it contained must be considered as second only in importance to those which were made by Mr Parsons after the successful trial of his first turbine driven steamer, Turbinia '

Mr Parsons's paper which was entitled The Application of the Marine Steam Turbine and Mechanical Gearing to Merchant Ships,' described the successful application of a combined steam turbine and reduction gear to a slow speed merchant steamer, the "Vespasian' The Vespasian' is a small cargo steamer of less than a thousand tons displacement, which in her original condition was driven by reciprocating engines which were sufficiently up-to-date to be considered as representative of the average engine-room equipment of the modern tramp steamer To make certain that the comparison would be trustworthy, and equally favorable both to the reciprocating and the turbine engine the reciprocating engines were thoroughly overhauled and put in first-class condition The ship was then taken to sea and put through a course of trials in which complete data relating to draft weather water and coal consumption etc, were collected The vessel was then returned to the yard the reciprocating engines were removed and a fast-running steam turbine with a 1 to 40 reduction gear was installed, the propeller used with the reciprocating engine being left untouched The reduction gear consisted of pinions on the high-pressure and low pressure turbine shafts and a large spur wheel on the propeller shaft The gears were of cast iron and the whole was mounted in plain bearings without the use of any special adjustment devices. The "Vespasian" was then taken to sea, and put through a similar course of trials to those which were run with the reciprocating engines Except for the substitution of turbines for reciprocating engines, the ship with respect to draft, boilers, and propeller was in exactly the same condition as in the first trials.

When the results came to be worked up, it was found that with seventy revolutions of the propeller, there was a net gain of from 15 to 16 per cent when steam for all purposes was considered, and of from 18 to 19 per cent for the propelling engines alone Translated into terms of boiler power, this means that one boiler out of every six in the slow cargo boat can be dispensed with

Speaking of the important question of the strength of the mechanical gearing Mr Parsons stated that as the 'Vespasian had been taken out in a heavy sea without experiencing any trouble with the reduction gear, it was probable that the gear would stand anything that the shaft would stand In the discussion of the paper various shipbuilders referred to the long-standing prejudice against mechanical gearing, and it was the general opinion that its rapid wear was due to the imperfections of manufacture which characterized machine work in the early days of the steamship, when gearing was used for speeding up the propeller just as to-day it is being used for speeding down The early mechanical gearing, moreover, because of its imperfection, was very noisy, but it was agreed that the almost perfect gear cutting which can be done to-day will practically eliminate the noise, particularly if the gear be suitably inclosed and sound-deadened

Mr Westinghouse recently proved, in the remarkable tests with a 6,000-horse power reduction gear which were carried out at the Pittsburg shops, that by the use of helical gearing, which is the type that was used on the 'Vespasian," it is possible to transmit large horse-powers with an inappreciable amount of wear and with an efficiency of over 98 per cent, which is about the same efficiency as was secured by Mr Parsons

Now the vast importance of these 'Vespasian' trials will be appreciated, when we bear in mind that about two-thirds of the steam merchant marine of the world is of the slow cargo-carrying type, for which the steam turbine, because of its high speed of revolution, has been found to be unsuitable Moreover, the 'Vespasian was the first vessel to be fitted with the new system and it is reasonable to conclude that with its further application to cargo steamers, an average *economy of at least 20 per cent will be guaranteed* on the engine and 17 per cent on engine and auxiliaries, or as Prof Ewing put it, there will be a saving of one boiler in six on the whole equipment.

Furthermore, not only will there be economy at the coal pile but the reduction in weights will make possible a considerable increase in the cargo-carrying capacity In this connection, it should be noted that the United States Navy Department has authorized the installation of Westinghouse turbines with Melville and McAlpine gears in the new fleet collier No. 8, which is being built at Sparrows Point, Maryland The space and weight saved by the use of this apparatus as compared with the reciprocating engines originally contemplated for this vessel, will enable it to carry about 200 tons more coal, and it is believed that the economy in coal consumption will be such that the saving thereby effected will add another 200 tons to the net carrying capacity of the collier

WATERWAY DEVELOPMENT IN EUROPE AND THE UNITED STATES.

We note that a contemporary sounds a word of warning against precipitate action in the wholesale development of the waterways of the United States, by drawing attention to a document issued by the British Royal Commission on canals and waterways, which it considers to be worthy of serious study on this side of the Atlantic The report deals with the waterways of Belgium, France Germany, and Holland, and our contemporary advises that it be studied in connection with the recent report of the army engineers on the proposed 14-foot waterway from the Lakes to the Gulf It is claimed that the Royal Commission report strongly sustains the contention of the army engineers that the Mississippi and its tributaries, with 14 000 miles of navigable waters, as developed and maintained by the government, furnish as good an inland waterway system as any in Europe

In France the waterways that are used considerably include a total of about 7,500 miles of rivers and canals, and of this 1,306 miles of rivers and 1,671 miles of canals have been deepened to a minimum depth of 6 6 and to a maximum depth of 6.5 feet, the bulk of the traffic being carried on water varying from 5 feet in depth down to 1 5 feet.

In Germany there are 8,500 miles of waterways, the depth of which in the rivers varies from 3 to 6 feet, while on the lower sections of the larger rivers the depth becomes from 8 to 10 feet. The depths of the canalized rivers are from 2.6 to 7 5 feet, and of the canals from 4 to 10 feet, from 4 to 6 feet being the most common Comparing these figures with those of the Mississippi, we find that, even in the low-water season, boats of 25 to 30 feet draft may be sent from the Gulf of Mexico 270 miles to New Orleans, Baton Rouge, and Bayou Sara. Boats of 9-foot draft may travel 840 miles farther to Cairo, those of 8-foot draft may pass from Cairo 182 miles to St. Louis; while those drawing 4½ feet may pass up the Mississippi, Illinois River, and Illinois State canals, a further distance of 365 miles to Chicago The Ohio has a depth of 9 feet from Cairo to Pittsburg, a distance of 1 000 miles.

Now, since the Mississippi and its tributaries actually constitute a better waterway system than any in Europe, the question is asked, Why is the river and canal traffic in Europe growing faster than the railroad traffic, while in the United States railroad traffic is rapidly increasing, and river and canal traffic falling off? One important reason is that both the municipal and private interests in Europe have provided the waterways with good terminals, and boats and barges have been developed which are specially adapted to river and canal traffic Here, practically nothing of the kind has been done

As an offset to these conditions, the advocates of larger waterway development are in favor of the construction of much deeper waterways than any in Europe, deep enough to allow lake and ocean-going vessels to pass through. When the government investigated this subject for the State of New York, the conclusion was reached that the cost of transporting grain by the typical lake freighter on a deep-water canal would be 38 per cent greater than by a towboat and barges on a barge canal, and it was this conclusion that led the State of New York to abandon the idea of a 20-foot canal

Our contemporary is of the opinion that it would be the very height of folly for the government of the United States, under present transportation and commercial conditions to spend hundreds of millions on the development of inland waterways believing that the only way by which considerable commerce could be diverted to the present or proposed waterways would be to compel the competing railroads to raise their existing rates on low-grade commodities and refrain from making reductions In France the government compels the railways to keep their rates at least 20 per cent higher than the rates on the competing waterways, this practice according to the report of the Royal Commission, being based on the opinion that waterways, because of the longer duration of transport, are not able to compete at equal rates with the railroads

OSMOTIC PRESSURE AND CURRENTS.

It is known that a current can be generated by forcing a liquid through a porous diaphragm or filter, but such currents were too small to be of practical value The matter has been taken up by a German scientist B Schwerin He claims to have obtained remarkable results in current production A liquid circulates in a tube of large diameter and at a high pressure Inside the tube is placed a filter through which the liquid passes, consisting of a certain thickness of a porous substance contained between two sheets of wire gauze The current is taken from each of the sheets by a wire To produce a current we must have the proper liquid and the filter must be specially made Adding suitable salts to water we find a high value for the current At the same time the diaphragm must be made of matter in an impalpable powder to be effective, so as to reduce the size of the pores As an example he uses a pressure of 5 atmospheres for the liquid, and a layer of finely powdered carbon ½ inch thick with a surface of 32 square inches, the internal resistance being 1 000 ohms when distilled water is used But a small current is now produced, but when we add ammonia to the water the current is increased ten times and the electromotive force twice, therefore we have 20 times the energy by using ammonia The best results are given by fine quartz powder and the use of a much higher pressure At 30 atmospheres we have as high as 32 volts and 0 8 ampere, or 2.6 watts, which is a very good result. The energy seems to vary as the square of the pressure, and at higher pressures we could obtain large currents. When the pores are finer the flow is lessened, but the energy is about the same. The liquid is best sent in a closed circuit of piping

HALLEY'S COMET

The first observations of the comet in the morning sky show that it is disappointingly faint. Its intrinsic light has evidently not increased as rapidly as in the case of some other comets. Unless there is a change in this respect, it will be far from conspicuous to the naked eye until the latter part of May, and those who wish to see it in the morning sky will do well to use field glasses, and to look for a much fainter object, with far less of a tail, than our front page illustration of last week showed.

ENGINEERING.

The Pennsylvania Railroad last week operated the first electric train through the tunnels under Manhattan Island and the East River. The train, made up of six construction cars and an electric locomotive, ran from the station in New York to the Thompson Avenue viaduct in Sunnyside yard, Long Island City.

An important link in the proposed waterway from the Lakes to the Gulf must be eliminated from consideration of that scheme, at least for the present. The section referred to is known as the Illinois River Deep Waterway, for which it was proposed that the State should spend $20,000,000, in the extension of the Chicago drainage canal down the valley of the Illinois River. The bills proposing to proceed with the construction were defeated in a special session of the Illinois Legislature, which adjourned last month.

The city of Seattle is doing some exceptionally heavy grading in the reduction of the steeper hills in that city. This grading, which has always been going on intermittently, has recently been undertaken on an ambitious scale, and under the present scheme over fourteen million cubic yards have been removed. When the plan is completed, the total will have reached thirty-four million cubic yards. The work is being done by the hydraulic sluicing method, and the present project covers an area of forty-three city blocks.

The Great Western Railway in England is installing a compact railway ticket printing machine. When a ticket for a certain station is required, the clerk touches an indicator which carries the name of the station, slips a blank into a slot, turns a handle, and the completed ticket drops out. At the same time a record of the sale is printed on a continuous strip of paper, together with the fare and all information required for bookkeeping. When the clerk goes off duty, he simply has to total up the continuous strip of paper and count his cash.

It is well understood among naval men that the speed of a vessel is affected by the depth of the water not merely in shoal places, but in the deeper waterways. With a view to determining what effect different depths of water have on speed, the Board of Inspection and Survey has arranged that the standardization trials of three vessels shall be made over three different courses. The battleship "Michigan" and the destroyers "Reid" and "Flusser" will have their trials over three measured mile courses, one at Rockland, Maine, another at Cape Cod, and the third in Delaware Bay.

The Mallet articulated compound locomotive continues to grow in favor, the reports from locomotives of this type which have been some time in service being in general very favorable. The New York Central system has recently put its first Mallet compound in service on the Boston & Albany line. The present class of heavy freight engine on that road has a maximum tractive power of 26 tons, whereas the Mallet, when working compound, has 33 tons, and when working simply 40 tons tractive power. The success of this type in freight service is undisputed. What results it will give in fast passenger service time will tell. The operation of the powerful express Mallet on the Santa Fé road will be watched with great interest.

Advices from Washington state that the chief of the Bureau of Navigation of the Navy, the aid for operations, and the aid for personnel, are mapping out another extended cruise for the Atlantic fleet. At present the scheme proposes a naval review at Hampton Roads, followed by the departure of sixteen ships in four divisions for Gibraltar, where the divisions will separate and visit the leading ports on the Mediterranean. It is possible, though not decided, that the fleet will proceed thence through the Suez Canal to the Philippines and San Francisco, returning home by the Straits of Magellan. The fleet will include the four new dreadnoughts, "Delaware," "North Dakota," "Michigan," and "South Carolina," and the "New Hampshire," "Mississippi," and "Idaho," seven of our latest battleships, which were not present on the former cruise.

We are indebted to Mr. Frank G. Taylor for the description of the new dam with which it is proposed to replace the wrecked structure across the Colorado River, which was carried away at Austin, Texas. The dam, which will be constructed of reinforced concrete, will rise 65 feet above low water and extend for 1,096 feet in length. The portion of the old dam which was not carried away will be incorporated in the new structure. It will be supplemented by a reinforced concrete addition, which will raise its crest eleven feet higher than the old dam. To prevent the recurrence of the seepage through the fissured rock, which was so disastrous to the old structure, curtain walls two feet thick are carried down thirty feet below water, and at the bottom of the trenches holes are drilled five feet apart to a depth of thirty-five feet, into which liquid cement grout will be pumped at a pressure of 150 pounds per square inch, thus filling the crevices.

ELECTRICITY.

Russia is becoming interested in hydro-electric power plants, and is examining into the matter of electrifying suburban divisions of its State railroads. An investigation is being made of our high tension transmission systems, and it is probable that a new field will be opened for American engineers.

An electric lighting plant in Nebraska is manufacturing ice as a by-product. The exhaust steam of the plant, which would otherwise go to waste, is utilized in the ammonia absorption process of ice manufacture and also for distilling water from which the ice is made. This venture, we are informed, has proved a very profitable one for the lighting company, and might be copied to advantage by other plants similarly situated.

A new system of treating eggs so as to prevent them from growing stale when in cold storage has been discovered in Rochester. This consists in subjecting the eggs to an electrical current. The theory is that eggs when placed in storage are alive and are gradually frozen to death, whereas if the life is destroyed by an electrical current before they are placed in storage they do not taste stale, even when kept on ice for a long period of time.

In an address recently made by Prof. John W. White, head of Johns Hopkins University, it was pointed out that out of the 220,000 miles of railroad in this country, only a thousand miles have as yet been electrified. He called attention to the fact that the electrification of the elevated railroads in New York resulted in increasing the capacity of the roads fifty per cent. To be sure, the questions of electrifying suburban, express and freight service require separate consideration, but Prof. Whitehead shows that in each case electrification is possible and often preferable.

Tungsten filaments are commonly made by mixing the metal in a paste that is then extruded in the form of a filament, after which the paste is expelled and the particles of metal are welded together by an electric current. This complicated method of forming the filaments is due to the fact that tungsten is not sufficiently ductile to be drawn out into fine filaments. An English concern has just discovered a method of producing drawn filaments of tungsten, and the General Electric Company has also just announced the discovery of a method by which tungsten may be rendered sufficiently ductile to permit of its being drawn into fine wires. The drawn tungsten filament is stronger than the filament made by the "sintering" process.

The Junior Wireless Club is making a strong protest against bills that are now before Congress aiming to restrict amateur work in wireless telegraphy. Particularly objectionable to them is the proposed annual fee of $100, to be exacted from all wireless stations. As there are between 40,000 and 50,000 boys in the country with their own wireless equipments, this virtually represents a tax of between four and five million dollars. Of course, very few boys could pay a $100 fee, and the result would be that practically all amateurs would be eliminated from wireless experimentation. It does not seem as though this would be advisable, because many of the improvements in wireless telegraphy have been the work of amateurs.

Explosions are often caused in flour mills and breweries by nails or other iron particles that find their way in the grain, and which when they strike the steel rolls of the mills produce sparks and ignite the finely pulverized material about them. Recently a large malting concern that had been troubled by many such explosions installed a set of electro-magnets over which the grain is passed before being prepared for shipment to the breweries. All iron particles in the grain are thus picked up by the magnets and 800 to 1,000 bushels of grain are cleaned per hour. When the magnets have collected a large amount of metal, they are swung to one side, de-energized, and swept clean of any particles adhering to them by residual magnetism. Since the installation of these magnets, there have been no explosions in the mills.

A series of tests was recently conducted for the Board of Education of Newark to determine the best form of lighting for schoolrooms. The rooms in which the experiments were tried measured 22 by 34 feet and were 12 feet high. Three systems were tried, consisting of twenty-two 16-candle-power lamps, five 75-candle-power graphitized filament lamps, and five 100-watt tungsten lamps with glass reflectors and frosted tips. The tungsten lamps were the most economical and gave by far the best light at each desk, as was determined by illuminometer readings. A similar investigation has been made in Boston, where it was suggested that the room be lighted by lamps placed along the side walls just under the ceiling in boxes with prismatic glass bottoms, which would cast the rays into the room at the desired angle.

SCIENCE.

According to the Journal Soc. Chem., it has been shown that small quantities of bismuth exert little or no influence on the chemical relation of copper and nitric acid.

At a recent meeting of the Royal Society of Medicine in London, a warning was sounded against the reckless use of radium. Even the reputed favorable effects of radium in the treatment of cancer were sharply criticised.

The Seine is the fourth largest river in France, ranking in size below the Loire, the Rhone, and the Garonne. Its drainage basin (30,370 square miles) is larger than that of the Susquehanna (27,400 square miles) or of the Sacramento (27,100 square miles).

Sir John Murray, K.C.B., the well-known naturalist, will head an expedition for biological and physiological exploration in the North Atlantic. Although much has been done in this region an enormous field is still unexplored. Sir John sailed from Plymouth on the 14th. The sea will be explored to the depth of 1,800 feet.

It is said that Prof. Karl Harries of the University of Kiel has produced a synthetic rubber. The actual details of the process are not before us. Attempts such as these have been made again and again, but with no commercial success. The most that can be said for them is that they indicate the possibility of producing a synthetic rubber from turpentine at some future time.

Dr. Robbins, an English writer, calls attention to the development of the jaws of English boys who were taken out of the streets of London and sent into the British navy. He says: "Undoubtedly the important notable improvement in them next to their superior stature and healthy appearance was the total change in the shape and expression of their faces. On analyzing this, one finds that it was to be mainly accounted for by the increased growth and improved angle of the lower jaw." The change is due to the rations of "hard tack" and "salt junk" upon which these lads had subsisted.

Savants from all parts of the world will gather in Pasadena, Cal., next August, and will ascend Mount Wilson. Almost one hundred leading scientists of Europe and America have accepted invitations extended by the Carnegie Solar Observatory to participate in the third regular convention of the International union for co-operation in solar research. Among these will be Prof. Ricco of Mount Etna Observatory, Sicily. Germany, England and France will send four delegates each. On Mount Wilson are mounted the largest telescopes in the world for the study of the sun, and by August a new one will have been completed. This will be a 150-foot tower telescope, which will have more than double the power of any other instrument of the kind for photographing the sun's rays.

Some years ago several applications of the Thorp plane replica diffraction gratings were exhibited, notably their use with an opera glass for eclipse work. The only disadvantage of these is the necessity of employing glass lenses for collimator and telescope, which not only increase the expense but render the instrument somewhat limited, in that the ultra-violet region of the spectrum is more or less absorbed. Recent experiments by Mr. C. P. Butler have shown that concave replica gratings can be made to give very satisfactory results, and by slight modifications of the design of mounting this form of spectroscope may be employed for any investigation for which the ordinary spectroscope is fitted. A valuable feature appears to be that the radius of curvature may be varied within very wide limits, thus providing instruments of different dispersion and light-grasping power.

The orbits of the two inner satellites of Uranus were determined by Newcomb in 1875. At that time no appreciable eccentricity could be certainly proved to exist in either orbit. Osten Bergstrand, of the observatory of Upsala, Sweden, has recently published a discussion of the observations which have been made of these satellites since 1894, chiefly with the great 36-inch equatorial of the Lick Observatory. Bergstrand finds that the orbit of the second satellite, Umbriel, is clearly elliptical and that its apse, or "periuranus," is subject to a secular displacement from which a flattening of Uranus at the poles may be inferred, and the value of oblateness approximately calculated. No conclusive result in regard to the oblateness of the planet has been obtained by direct observation. Bergstrand deduces from the observations, also, the values of the major axis and eccentricity of the orbit of Umbriel and that of the mass of Uranus, which he finds equal approximately to 1/23300 the mass of the sun. This value in combination with Barnard's value of 2.075 seconds for the angular equatorial radius of Uranus, makes the density of the planet 0.16 that of the earth. Bergstrand's values for the mass and density of Uranus are smaller than those which have hitherto been accepted.

THE EROSION OF BRONZE PROPELLERS

ONE EFFECT OF THE HIGH SPEED TURBINE

The introduction of high-speed turbine engines has produced a serious amount of erosion in propellers made of high tension bronze—a material which until recently showed no serious erosion effects. The trouble which the bronze manufacturer has been chiefly occupied in preventing was corrosion both chemical and galvanic but erosion or the mechanical breaking up of the material by the action of the water, was formerly never considered. One of the most astonishing cases of severe erosion occurred in the case of the Cunard liner 'Mauretania', for after she had been in service about three months, on drydocking the ship it was found that all the bronze propellers were badly eaten away, those at the stern being least affected. The area that suffered most was situated about two feet from the root and toward the after edge of the blade. The corroded area amounted to three or four square feet, and the metal had been eaten away in depths which varied from a quarter of an inch to two and a half inches.

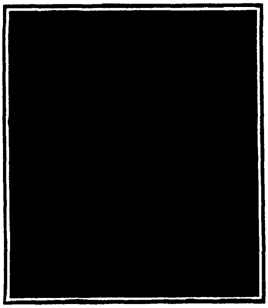
A very thorough examination of the problem was made by Dr Oswald Silberrad who, after an exhaustive series of laboratory and other experiments, determined that the deterioration was due to erosion, and found that it could be prevented by the use of a special bronze alloy whose chemical and physical properties were designed specially to meet the condition.

Dr Silberrad came to the conclusion that since the material withstood the old conditions of propeller service, the primary cause of the deterioration was due to the modified conditions of higher propeller speed, etc. In discussing the new conditions he calls attention, first, to the terrific surface friction of the water. The "Mauretania" was originally fitted with four three-bladed, built-up propellers, of the usual high tension bronze that has been employed for many years for the propellers of Atlantic liners. They were a little less than 17 feet in diameter, and upon the westward voyage the average revolutions of the engines were 174, the horse-power developed being about 68,000. The perimeter of each propeller travelled through the water in a helical path at a speed of about 105 miles per hour, and transmitted to the water during the whole of the voyage no less than 17,000 horsepower. "The consideration of these figures," says Dr Silberrad, "enables us to realize that, under such conditions, the water becomes a very rough file for any alloy to withstand, and when the standard bronze, which has proved so serviceable in the past was subjected to these conditions, we can scarcely be surprised that it failed."

A curious feature in the problem was the wide and marked divergencies in the degree and position of the deterioration in the various propellers examined. Thus in the sister ship 'Lusitania," where the conditions were at first apparently identical, the backs of the propellers were quite as much affected as the faces. Moreover, the propellers of certain destroyers showed a maximum damage at the base (see illustration) where the helical velocity is least. In looking for secondary causes, "dirt in the castings" was excluded because the eroded castings proved to be exceptionally free from dirt, "galvanic action" also was shut out by the fact that analysis showed that no large concentration of copper had occurred on the eroded surface. At the same time the areas of maximum deterioration do not coincide with the view that erosion is *alone* the primary cause, since these areas in no case occur at the extreme tips of the blades, where the helical velocity is greatest.

After a prolonged research, involving the examination of a large number of cases of propeller deterioration, it was proved that the trouble was *primarily* erosion, although the degree to which secondary causes entered into the problem varied more widely than was anticipated.

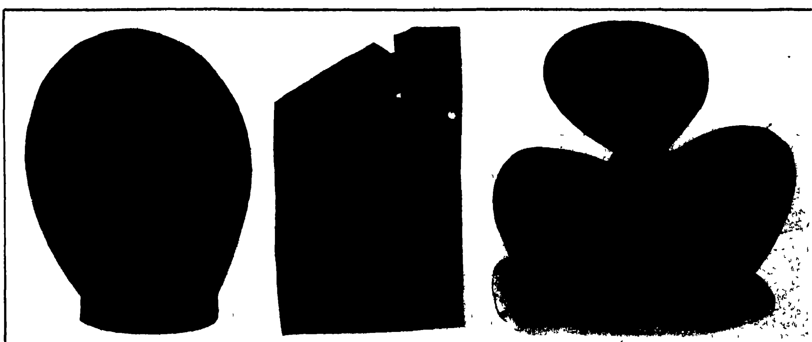
In a series of tests to determine the relative resistance to erosion of a large number of different alloys it was found that the number of hours necessary to produce a certain deterioration varied from 24,700 hours, the time of the regular standard bronze, to 117,200 hours for Parsons new turbine alloy, which was used to cast the new four-bladed, solid propellers with which the "Mauretania" and "Lusitania" have been equipped. An examination of these propellers, each of which weighs about twenty tons, was made after they had been running for nearly six months, by the surveyor for Germanischer Lloyd, who reported that he found them in perfect condition. It is significant, also, that since their adoption for the forward, or wing shafts each of these ships added about three-quarters of a knot to its previous best speed. As the same four-bladed propellers are to be fitted to the other two astern shafts it is likely that the transatlantic speed may be raised this summer above the 26.06 average at which it now stands.



One of the new solid propellers of the "Mauretania" of special turbine alloy, which fail to show any erosion.

It was in 1850 that Mr. Hind read a paper before the Royal Astronomical Society in which he traced the appearances of Halley's Comet through the ages with the help of the Chinese annals, which had only recently become known in Europe. Although he was sometimes wrong, he was nearly always right. He believed that in the Chinese annals he had found credible references to Halley's Comet back to the year B. C. 11. He regarded it as certain that Halley's Comet reached its perihelion in 1378, and therefore, allowing the normal periodicity, he looked for some mention of it about the year 1301. The Chinese annals definitely describe a great comet in that year. There was one European account of it by Friar Giles which was not reconcilable with the Chinese record. If the Chinese were describing Halley's Comet it seemed that Friar Giles certainly was not. Hind was led to an examination of Giles's credibility. He discovered that his account of another comet in 1264 was so contradictory that he had no hesitation whatever in preferring the Chinese statement for 1301, and concluded that the comet of 1301 was Halley's. He believed that the preceding return of the comet was in 1223, when, in July, shortly before the death of Philip Augustus, a comet was seen for eight days in the evening twilight. The Chinese annals do not mention this comet, but they mention comets in the years 1222 and 1224, neither of which Hind thought closely resembled Halley's Comet. Cowell and Crommelin have shown that Hind was wrong about the particularly bright comet of 1222, which was unquestionably Halley's Comet. Not all of Hind's "ascriptions," as art critics say, are reconcilable with Cowell and Crommelin's latest calculations, but enough is established on all hands to prove that Halley's Comet has been appearing ever since the history of the skies has been written.

A new type of locomotive designed to secure smokeless combustion of bituminous coal has recently been tried on two or three of the railways entering Chicago. The apparatus is designed to operate on the coking principle. The coal is so fed as to admit of the gases being first consumed, the resulting coke being fed to the grates and consumed without the black smoke of more rapid and incomplete combustion. Within the fire-box is a magazine which may be changed in quantity, a ton at a time if desired, from which the coal is automatically fed to the fire. A rotary fan underneath the fire-box affords a supply of fresh air to assist the proper combustion of the gases before they escape through the tubes, and supplies the necessary draught. The arrangement has been used with some success in connection with stationary plants, but there appears to be some skepticism whether the fire thus produced will be of sufficient intensity for locomotive purposes.



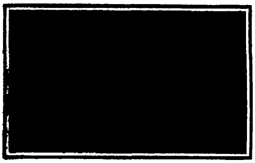
Erosion of bronze blade of "Mauretania" after three months' service. **Portion of torpedo-boat destroyer showing severe surface erosion.** **Bronze propeller of a destroyer, showing pronounced erosion about the root section.**

THE EROSION OF BRONZE PROPELLERS.

HOT-AIR SHOWER BATHS FOR VETERINARY PURPOSES

BY DR. ALFRED GRADENWITZ

Electric hot-air fans have been employed for some time in medical practice, and have undergone during the last few years most interesting alterations as regards form and use. In their original form they were used for drying hair by means of an air current produced by an electric fan, and heated by an electrical resistance.



THE HOT-AIR VENTILATOR. A SERIES-WOUND ELECTROMOTOR IS HIDDEN IN THE HANDLE.

This current of heated air was soon found to possess striking curative effects. In connection with maladies such as gout, rheumatism, neuralgia, etc., a daily application lasting ten to fifteen minutes would alleviate, and in the case of prolonged treatment even cure these ailments. It is true that the limbs affected being especially susceptible to cold after the treatment had to be carefully protected by warm clothing.

Some time after the new treatment had been introduced in medicine, hot-air currents were found to exert striking curative effects on morbid tissues and in furunculosis, abscesses, etc., on account of the hyperæmia (abundance of blood) produced by them. Thus hot-air shower baths have been adopted in an extremely short time, not only in hospitals and sanitoria, but in the consultation rooms of specialists as well as those of the ordinary practitioner. Their ease of handling, the readiness of the hot-air fans for use in working at a moment's notice after being connected with an ordinary contact box, and the control of the heat effects at will by a special switch, have greatly facilitated the adoption of the shower baths. In fact, hot-air ventilators are able to generate in half a minute a strong air current up to 212 degrees F., a result impossible with any other apparatus.

The electrometrical instrument factory of Dr. Richard Heilbrun in Berlin has recently extended the use of hot-air shower baths to veterinary practice. The ventilator used in this connection comprises a series-wound electromotor hidden in the handle of the apparatus. The electrical radiator heating the drawn-in air current to a temperature up to 212 degrees is carried by a connection tube 40 millimeters in diameter. The weight of the apparatus is about 2 pounds, the current consumption of the motor under a tension of 220 volts is 0.2 ampere, and that of the radiator 2 amperes. A nickel funnel 100 millimeters in length and 20 millimeters in diameter fitted over the mouth piece allows a hot-air current of increased intensity to be generated, which is particularly valuable in connection with a localized treatment.

As dogs and horses are especially susceptible to

THE HOT-AIR SHOWER BATH AS OPERATED IN LOCALIZED TREATMENT

catching cold, the hot-air shower bath affords an effective means of alleviating and curing their ailments, even the most nervous dogs becoming [illegible] to the unusual treatment after its first application.

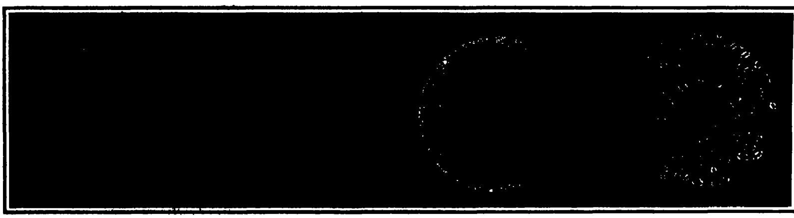
THE MICROSCOPE AS FOOD DETECTIVE

BY P. HARVEY MIDDLETON

Probably no other form of wrongdoing so vitally affects us as tampering with our foods and medicines. Of course the law allows the presence of a certain percentage of preservatives in foods, but it is the excess of this allowance that causes a continuous war to be waged between the traders and the representatives of the law. And so profitable a proceeding is the importation of inferior material into the food of the American public that many large firms employ skilled chemists at a high salary in order that their expert knowledge may assist them to drive a coach and four through that most far-reaching and radical law of modern times, the Food and Drugs Act of June 30th, 1906, and fatten on the proceeds.

In what a remarkable manner our food is tampered with may be gleaned from the fact that a large and highly trained staff of inspectors and their assistants are engaged under the Food and Drugs Act to detect offenses of this kind, and great are the difficulties with which they have to contend. For instance, it is a chemical task to prove that poisonous copper salts are applied to bottled vegetables to give them color, and a microscopic achievement to show that a concoction labeled and sold as arrowroot is no [illegible] of the kind, but chiefly potato starch. It is difficult to prove who puts brick dust, peroxide of iron, or arrowroot in a harmless-looking packet of cocoa, or which hand introduces substances derived from coal tar into wines, syrups and drugs to make them more attractive to the [illegible]. [illegible] violet coloring matter boasts a name of fifty-five letters [illegible] diethyldibenzyldiethyltriamidotriphenylcarbi[illegible]disulfone.

The alleged olive oil used in salads is often cotton

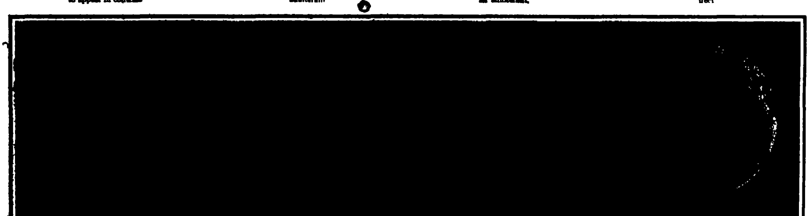


Black pepper adulterated with ground olive pits. The pepper starch has been colored black with iodin, causing the olive cells to appear in contrast.

The angular bodies are pepper starch and the rounded bodies are bean starch which is used as an adulterant.

The round grains are potato starch and the angular grains are corn starch used as an adulterant.

Bean starch photographed with polarized light showing characteristic [illegible] effect.



Chicory, showing some of the characteristic sap vessels by which it is detected when present in coffee.

Cream thickener composed of corn starch (angular bodies) and gum tragacanth (laminated portions).

Pollen from honey. The various forms indicate the different plants visited by the bees.

Celery seed adulterated with ground rock, the latter indentified by its angular form.

THE MICROSCOPE AS FOOD DETECTIVE.

seed oil, and such substances as burnt sugar Cayenne pepper, acetic ether, tannin, crude cream of tartar, and French plum juice are frequently imported into brandy and whisky

The term 'adulteration' when applied to food or drugs is broad in its scope, but has been given a well defined legal meaning In general it may be said that adulteration consists in injuriously subtracting from a substance any part of its natural or inherent qualities or adding to it any ingredient which would render the article of a different nature than that of its expressed and natural form

Almost coexistent with the growth of this wonderful country, and seemingly as a part of the fierce business competition which has insidiously developed, this evil of food and drug adulteration has arisen The conditions of substitution and adulteration of foods and drugs were little short of deplorable less than a decade ago For seventeen long years the bill which has now become the Pure Food Law lay at the door of Congress and during all that time it was bitterly opposed by the manufacturers who had so long enjoyed unmolested their privilege of supplying the dinner tables of the nation with impure foods misleadingly labeled

While this act has done much good, there is still a very considerable amount of adulteration practised Pepper adulteration is still remarkably common and "Pure White Clover Honey is concocted by the imitators of the busy bee from glucose Other enterprising manufacturers will cause two grains of Cayenne pepper to grow where only one grew before by making one of the grains grow out of sawdust Ground peas and beans may be found in black pepper, and celery seed may be adulterated with forty per cent of powdered rock

In order to run down one class of food faking, the pure-food experts at Washington have introduced the microscope into their work It can be readily understood how gross adulteration may be detected by a simple microscope, as for instance when foreign seeds gravel, or powdered rock have been mixed with whole small spices. The adulterant may be of such a character as to escape the notice of the ordinary buyer, though with even a small lens or reading glass the foreign substance may be seen to be very different from the true spice

The usefulness of the simple magnifier in examining food and drug materials, however is of little value for the examination of products which are made up of small particles such as flour, ground spices and powdered drugs In such cases recourse must be had to the compound microscope with a magnifying power ranging from fifty to four hundred diameters

The world's supply of starch comes for the most part from a limited number of plants, twelve or fifteen include nearly all that are of much commercial importance To the naked eye these starches all appear as a fine white powder, but under a microscope grains or granules are seen which vary more or less in shape, size rings nucleus and action toward polarized light. Some of the grains are almost spherical, others are angular or ovoid and still others are very irregular in outline In diameter they vary from one-tenth to one-thousandth of a millimeter In no variety are all the starch grains of one size, but usually there are fairly well-defined limits The way in which they sometimes vary will be seen by reference to the photographs reproduced in this article Most of the grains show, more or less clearly fine lines of rings upon the surface. In some varieties these are arranged concentrically, while in others they are eccentric

"A hilum (nucleus) whose form and position varies widely in certain species commonly occurs in starches," says B J Howard, who has charge of this microscopical work in the Bureau of Chemistry at Washington "In some it is at the center as in corn and wheat starches, in others near one end, as in potato and arrowroot When viewed in polarized light starches show more or less strongly a cross with the bars passing through the hilum Wheat starch has a central cross while in maranta it is eccentric and well defined Bean starch which illustrates the leguminous type, has a spindle-shaped cross In the oat a number of starch granules are joined together forming a mass When these masses of starch are examined under polarized light individual grains in the mass have their own individual effect, and interfere so with each other that there results little more than a hazy glow of light"

By becoming familiar with these characteristics it is possible to identify with considerable accuracy nearly all of the commercial starches Potato starch adulterated with corn starch wheat with corn flour, and buckwheat with wheat are examples of those most easily detected One of our photographs shows a picture of potato starch adulterated with a considerable amount of corn starch The grains of the latter are easily distinguished by their angular form

Another interesting application of the microscopic method of food analysis is found in the examination of spices. Many of these naturally vary so widely as to ash, fiber, etc., and in taste that it is impossible to identify certain kinds of adulteration by chemical and physical means alone. A study of the structure of pure samples will usually fit the analyst to detect adulteration in the ground spices as well as to identify the adulterant used In order to work most intelligently, however it is imperative that the analyst should have a good foundation in histological botany, since in this class of products the plant cell in its various modifications becomes the means of identification. In an examination of this sort nearly all kinds of plant tissue are to be considered, because some spices are derived from roots, as ginger, some from barks, as cassia and cinnamon, some from flowers, as cloves, some from seeds, as mustard, some from fruits, as red pepper, black pepper, etc, and some, such as sage and thyme, from leaves.

"Unfortunately," says Mr Howard, "most of the substitutions used for adulteration have a structure very different from the genuine spices For example, although pepper may be adulterated with ground peas, or beans, it may not always be detected by chemical means, especially when olive pits or pepper shells have been added to counteract excessive starch present in beans A microscopical examination will reveal such adulteration at once by showing the presence of the large starch grains characteristic of certain legumes. In pepper the starch is present in angular masses made up of small grains."

It sometimes occurs that a manufacturer has added so large an amount of corn meal or foreign ground shells and fruit stones to a pepper as to make the adulteration apparent to the taste by the lack of pungency, which is often corrected by adding a small amount of Cayenne pepper A sophistication of this kind can be readily detected by the microscopic method of analysis, because the tissues added are so distinctly different from normal pepper tissue In one of our photographs is shown the microscopic appearance of a sample of pepper which was grossly adulterated with ground olive stones The starchy material has been stained black in the picture, while the partly clear portions, more or less oblong in form, are the stone cells of the olive pits

The capsicum fruits are readily identified by means of certain cells found on the inner portion of the pericarp (pod) and others on the seed coats. These cells have characteristic sinuous outlines which make them easy to detect even when present in very small numbers.

In coffee and chocolate preparations roasted chicory, cereals, and peas in the case of the former and starchy materials and cocoa shells in the case of the latter, are sometimes used for adulteration Coffee, being the seed of a plant has a structure which is very different from chicory, which is a root. The cell walls of coffee have a characteristic beaded appearance which is present in but few other seeds Even after roasting and grinding these beads can be easily distinguished while chicory contains sap vessels by which it can be detected

Chocolate and cocoa are made from the seeds of the cocoa plant, to which foreign starches are sometimes added Cocoa beans contain naturally a considerable amount of starch The grains are small in size and are easily distinguished from the starchy adulterants, such as corn and wheat flours or potato corn, and arrowroot starches An artificial chocolate coating has been examined which was composed of cocoa shells, corn starch, beef tallow and some mineral matter, probably used as a coloring substance

In the production of artificial jellies jams, and some kinds of confections various thickeners are used among which might be mentioned gelatin, starch, agar-agar gum tragacanth, and gum arabic Some of these are difficult of identification, while others can readily be detected Agar-agar is a product made from certain seaweeds, and usually contains the siliceous shells of diatoms These shells are characteristic and quite easily detected in the sediment from the bottom of a dish after the material has been digested with dilute nitric acid One of our photographs shows such a diatomaceous shell obtained from a sample of artificial 'lemon slices" in which was found that the jellying material was agar-agar

Starch can easily be detected by microchemical and microscopical tests. Gum tragacanth and some other gums of this class contain a certain amount of small starch grains. When allowed to swell in water, a delicate laminated structure is developed by which these gums are disclosed even in such products as ice cream and marmalades.

A sample of thickener for cream composed of corn starch and powdered gum tragacanth is shown herein, and illustrates this feature quite satisfactorily In this case the corn starch is shown plainly as the angular particles, while the striated bodies near the center of the field are swollen fragments of the gum. The microscope is also of service in the examination of certain edible fats. Thus, if pure lard is dissolved in ether and the latter is allowed to evaporate slowly under proper conditions, crystals of the lard will be formed. These, if normal, will appear under the microscope as narrow plates with chisel-shaped ends. Beef fat treated in a similar manner will normally crystallize out in sheaf-like tufts of crystals, the ends of which are nearly or quite needle-like

Another application of microscopic analysis is in the identification of the flowers from which honey is made. This is of practical value in the analysis of honeys purporting to be from certain flowers. Although bees will almost invariably gather honey from several kinds of flowers, sometimes one or another of these predominate to such an extent as to impart a distinctive color and taste, enough to allow the honey to be called by that name By microscopic examination it is readily ascertained whether a so-called apple-blossom honey or an orange-blossom honey is really largely derived from the source claimed A photograph showing several kinds of pollen found in an ordinary sample of honey is reproduced

Correspondence.

THE INVENTION OF THE PLAYER-PIANO.

To the Editor of the SCIENTIFIC AMERICAN

I must file a demurrer to an impression created by the illustrated article which appeared in your issue of the 9th inst., under the heading "Ringing Chimes by Perforated Music Sheets." In referring to John McTammany as one of the inventors of the player-piano, I think an erroneous impression is thus conveyed regarding McTammany's true relation to the development of the player

As a matter of fact, he is known and conceded to be the father of the player by everyone in the piano trade familiar with the player history, and his claims to its inventorship stand unchallenged up to this moment. We do not refer to McCormick as one of the inventors of the reaper or to Howe as one of the inventors of the sewing machine nor to Cristofori as one of the inventors of the piano, although other men besides those mentioned contributed greatly to the development and improvement of the aforesaid inventions.

The history of every great invention has demonstrated that some one man has stood out pre-eminently from all his fellows in the course of its development, and the player has been no exception, and the one man who above all others stands forth pre-eminent in the player field is John McTammany, while around and about him, like so many satellites, have stood other men who have contributed of their genius to develop and improve the invention In the case of the reaper it was McCormick who overshadowed all his contemporaries, on the other hand Howe was the presiding genius who led the sewing-machine pioneers, while Cristofori was the pre-eminent genius who first conceived and developed the piano

It is true that others have improved upon the hand work of McCormick and Howe as well as upon that of Cristofori, but nobody has been able to eliminate the elements which they introduced into their respective inventions, and so long as those essential elements remain in their respective devices, just so long those inventions shall be attributed to the men we have mentioned But the piano invented by Cristofori was a mute and silent piano, and such it remained from the time it was invented, in 1709, until 1876, when John McTammany breathed within its wooden walls the breath of life, and henceforth it became a living, breathing, yea, almost a human thing, until to-day it stands forth the unsurpassed and unchallenged king of musical instruments. The following definition of the player has been accepted by the piano trade as authoritative

"Player, a musical instrument consisting of a casing two actions and a series of sounding devices within the casing, one of said actions adapted to be operated manually, the other designed to be operated mechanically by means of a perforated sheet on rolls, a wind, spring, or other motor for feeding the sheet and winding the rolls, a bellows and mechanism put in motion by it for actuating the sounding devices of the automatic action foot pedals or power for driving the motor, and means for controlling the tempo and varying the expression."

Now the first man to embody the foregoing elements in a musical instrument was John McTammany, and it follows that if McCormick is the inventor of the reaper, Howe of the sewing machine, and Cristofori of the piano, by reason of the fact that they were the first to embody in their respective devices the essential elements which distinguished those inventions to-day, and the elimination of which would make them worthless, then by the same token John McTammany must be regarded as the father of the piano-player mechanism, for no practicable or salable player has yet been made that did not contain the elements first embodied by him in a practical working instrument as early as 1876, and which was publicly exhibited in St. Louis the same year and described by the press of the country at the time, while your own files will show that Munn & Co applied for a patent on this identical invention on behalf of McTammany on September 7th of the same year, and prior to that nothing in the nature of the present player was known to the Patent Office or the public, either of this country or Europe.

WILLIAM N. TYLER,
Editor Music Industry.

THE SOLAR AND LUNAR ECLIPSES IN MAY, 1910

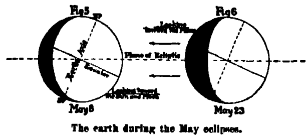
BY FREDERIC R. HONEY, TRINITY COLLEGE

An examination of some of the conditions which govern the moon's motion reveals the great complexity of the lunar problem. While the earth's volume is nearly fifty times the moon's volume, its weight is more than eighty times—the density of the moon being only six-tenths that of the earth. As a consequence, the common center of gravity of the two bodies is within the earth at a distance of over a thousand miles from its surface, and it is this point which moves in an elliptic orbit around the sun. Twice each month the earth and the moon exchange places with reference to the sun. The moon's orbit is an ellipse with the earth at one focus, and the plane of the orbit is inclined at an angle of a little over five degrees to the ecliptic. The eccentricity is one-eighteenth, but the elliptic form is subject to great variations. The moon revolves around the earth at an average velocity of a little over five-eighths of a mile a second, but its path in space is the resultant of its motion in its orbit and of the earth's motion at a velocity of eighteen and five-tenths miles a second, illustrated at Fig 1. The arrows A and a represent the velocities of the earth and the moon in their respective orbits. When the moon is at M, between the earth and the sun, the direction of the moon's motion is opposite that of the earth. At M' the earth and the moon are moving in the same direction. At these points and at any intermediate point M'' or M''' the moon's path is the resultant of the two motions. The plane of the moon's orbit rotates slowly in a direction contrary to her orbital motion, and the perigee has a slow motion in the same direction as that of the moon.

While the conditions which determine the moon's path are complex, observations extending over long periods of time show regularity in the recurrence of eclipses. (See SCIENTIFIC AMERICAN, September 12th, 1908.) The direction of the line of nodes is shown in the plot of the earth's orbit for November 1909 at the date of the last lunar eclipse, and also in the plot for May, 1910. During the interval this line rotates through an angle of over nine degrees. If the positions of the earth at the dates of the solar and lunar eclipses in May be carefully plotted, and the moon's orbit magnified, the situation of the moon relative to the ecliptic may be determined by an inspection of the plot. The arrow A shows the direction of rotation of the orbit, and a that of the moon's motion.

At the date of the solar eclipse (May 8 7 d.) the moon's orbit radius is projected on the plane of the ecliptic in the earth's orbit radius, and the moon's position is in that part of the orbit which is below the ecliptic. This is shown more clearly in Fig 2, in which the orbit is magnified one hundred and sixty times. The moon's position is shown at Greenwich noon from May 1st to the 28th, and also at the dates of the eclipses. On May 8 7 d., the date of the total eclipse of the sun, the moon will be nearer perigee, and approaching the ascending node N which will be reached between the 9th and the 10th. The enlarged plot shows clearly that the moon will be below the ecliptic. Its shadow will therefore be projected on the southern hemisphere. The path of totality will be between latitudes 40 and 70 degrees south, and as a partial eclipse it will be visible in Australia, New Guinea, and Java. On May 23 74 d. the moon will be below the ecliptic, and will pass the descending node N' on the same day. The beginning of the eclipse will be visible in portions of Africa, southwest Europe, North America except Alaska, South America, and the southern Pacific Ocean, the ending visible in South America, North America excepting Alaska, and the central and southern Pacific Ocean.

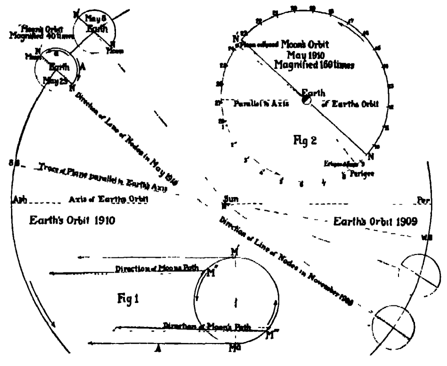
In Figs. 3 and 4 a portion of the earth's orbit in May and the moon's orbit are drawn to the same scale, showing the projection on the plane of the ecliptic of the moon's path in space between the dates of the eclipses. The plot by the larger scale (Fig 3) shows how points on the curve are obtained between the dates May 8th and 11th, Greenwich noon. The moon's orbit radius is drawn parallel to the position for each date in Fig 2, and the curve is traced through the positions of the moon. The orbit of the moon at the date of the solar eclipse is also shown. In the



The earth during the May eclipses.

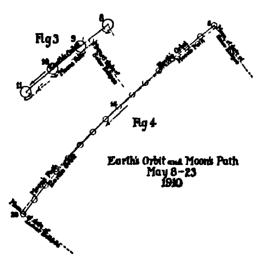
curve of the moon's path (Fig 4) there is no point of inflection, that is, it is always concave toward the sun. The earth moves about three and one-third times the diameter of the moon's orbit each day.

Figs. 5 and 6 are projections of the earth on a plane



Velocities and motions of earth and moon in their respective orbits. Smaller diagram shows the moon's orbit highly magnified

which is parallel to its axis, and perpendicular to the plane of the ecliptic. In these projections between the vernal equinox and the summer solstice, more than one-half of the visible surface is illuminated. The arrows show the directions in which the eclipses will be observed.



Projection of the moon's path on the plane of the ecliptic.

THE SOLAR AND LUNAR ECLIPSES IN MAY, 1910

The Fast Mail of the Future.

The principle of a mechanical delivery of mail has been established by the highly successful use of the pneumatic tube. This device is not the least conspicuous among the technical installations in the large cities, and probably will be applied to a greatly ramified postal enterprise in the near future. The chief question that arises in consequence is whether a system of delivery similar to that of the pneumatic tube can be installed for greater distances and at the same time afford an enlarged rate of speed. At the present day pneumatic postal delivery is found only in the large cities, and being restricted to local business, asks a rather exorbitant price for such service. It is plain that the employment of such a mode of distribution to distant points consequently among the cities also must give a wholly new aspect to the present systems of commercial intercourse. The first attempts made for the development of this idea were those of a company formed in Paris. A recent number of Der Electrotechnische Anzeiger states minutely the technical formation and other progress of this enterprise which has reached the stage of thorough practicality, the result of the quite facile function of the experimental line in use. For the near future the Paris company intends to connect the larger cities of France through electric postal routes that shall not have frequent intermediate stations. The rate of speed proposed is 250 km. (155 miles) an hour. The capacity of the automatic express car is to be 2 cu. m. (2.6 cu. yds.) approximately and the weight of a load consisting of letters and other postal pieces of smaller dimensions shall not exceed 100 pounds.

The roadbed so to speak, on which such delivery shall be practised must of course, be separated definitely from all other avenues of physical communication must be inaccessible to the public and this result can be procured only either through an elevated road or through a tunnel. For their experimental road the company has chosen the latter device and has built a tunnel which contains two rails, one above the other and of which the cross-section measures 8 sq. m. (9.5 sq. yds.) For the round trip beginning at intermediate stations branches and switches are provided. The function of the experimental road, procured through an electric circuit, is such that the highest speed is reached very quickly. The cars have two wheels which run on the lower rail and also two rollers which follow the upper rail and hold the cars in position. The cars, moreover, have a middle compartment for mail, and other divisions for the motors and the devices used as brakes. In front and behind the body of the cars is a conical point to diminish the resistance of the air. The frame of the cars is of iron exclusively. The motors are attached to the frame by means of levers which swing around an axis perpendicular to the direction of travel. The current is applied through an upper conduit and the brakes are worked by compressed air as well as by the resistance of the air artificially increased by the wings attached to the sides of the front end of the cars. These wings stretch out to catch the air. This device can stop a car within one minute and in a distance of three kilometers after the current is interrupted but is used only as an accessory to prevent the too rapid destruction of wheels and rails through the exclusive use of the rail brake, a source of most active friction.

A patent recently granted to Carl Farkas of New York, describes a method for making incandescent lamp metallic filaments which consists in producing on a conducting core a highly refractory coating by decomposing in a vacuum the vapors of a salt of a highly refractory metal in the presence of vapors of pyrogall, with final reduction in a vapor of hydrogen. In detail, the vapors of chloride of chromium and pyrogall are introduced in a vacuum containing the conductor, which serves as a core which latter is then heated by the passage of a current the vapors are thereby decomposed, nascent carbon from the pyrogall acting as a cement chromium probably being formed. When the coating has thus been produced the vapors are removed and hydrogen gas introduced, whereby the deposition is reduced to metal.

Some of the little craft that competed in the racing.

MODEL MOTOR-BOAT RACING

BY H. D. JONES

Model motor-boat racing, a new sport, has caught the popular fancy in England, and is being taken up in all the large cities. With a view to encouraging owners of models to enter their boats in the various competitions, challenge cups are offered by the clubs, and the conditions are made so broad that every designer feels that there is a chance to win a trophy The prizes are awarded for speed, for workmanship, for the general appearance of the models, for the behavior of the machinery and the performance of the boats while on the water

Not less than 5,000 spectators gathered recently at Clapham Common, one of the many open spaces in South London, to witness the regatta on the lake The competition brought to the front some of the speediest racing models, some particularly fine ones of saloon steamers, liners, and torpedo boats, and other craft that were built for appearance rather than for racing

The rules of racing were very simple Each owner started his model boat to run a straight line over the course at the end of which officials appointed for the purpose waited to "catch" the racers and return them to their owners. After the models were once started no interference was permitted, the ability of the unguided boat to keep in a line for the finish of the course being part of the qualifications for prize winning

Over a course measuring fifty-one yards, four boats were started in the first race, at which the accompanying pictures were taken The best time was made by a steam hydroplane, the "Folly," in 9 1-5 seconds, "Sunny Jim ' a gasoline craft, did the distance in 12 3-5 seconds, "Leda IV," a steamer, covered it in 15 4 5 seconds, and the fourth steamer, "Idunno," in 21 seconds

On running off the final heat, boat against boat in pairs the 'Sunny Jim" scored three wins, the "Leda IV two wins and the "Idunno" one win thus taking first second and third prizes in the order named The prizes were silver cups The "Folly," the fastest boat in the eliminating trials, unfortunately ran off her course in the finals through her propeller fouling, and not being able to get going in the others, she had to give her opponents a walk-over

Steering troubles were responsible for many awkward results in the other races. While hailed by the spectators as adding greatly to the enjoyment of the regatta, the failure of the little craft to keep their pointing and the perversity of the machinery when left to its own resources proved sources of great disappointment to the owners of models that failed to keep a true headway Boats that had run as true as a die on practice spins exhibited a tendency at the regatta to run anything but straight, or not to run at all Gasoline motors refused to start, pumps gave out, boilers leaked and the models exhibited a crankiness that showed there is a lot of improvement necessary before this sport can be brought to perfection. But that is why the regattas are encouraged The weak points of the models are strengthened, and motor-boat building is benefited as the result of the lessons learned from the eccentric performances of the models in the cup races.

The reliability of electric power in model regattas was demonstrated again and again, one finely-modeled liner, the "Fairholme," although not built for speed, scoring through the certainty of her performance and the untrustworthiness of some of her competitors. The surprise of the meeting was the performance of a finely modeled gasoline boat, the "Silver Dart" So fast was this entry, that the officials stationed to catch the models at the posts could not reach her when a little off the line, and she swerved away Heading off down the pond, the little boat eluded a second attempt at seizure, and before she finally came to hand she had completed two round trips in brilliant if somewhat erratic fashion, to the admiration of the spectators.

The expediency of running the regattas on a circular instead of a straight course is also engaging the attention of the experts, the difficulty of handling and controlling the big fast boats being very evident. In sending these speedy craft on a straight run across a small pond serious accidents seem unavoidable. One beautiful model, the "Moraima II," after accomplishing several fine sprints, eluded the catchers, dashed off on a course of her own, and wound up a series of mischievous gyrations by running full tilt into the bank, seriously damaging her hull and deranging the machinery On a large lake, with a round course, such accidents, it is thought, might be avoided by a circle of catchers standing ready to keep the boats on their way until the distance is completed.

The model motor-boat regattas have justified their existence by promoting improvement and bringing unknown designers and inventors of motor-boats and motor-boat machinery to the front. Instead of proving their boats in timid retirement on some out-of-the-way pond, a test that affords no possibility of comparison with the work of other designers, a number of men with kindred ambitions are brought together in these challenge meetings, and the test of the new boats capabilities is thorough and convincing.

The sport has progressed so far that a national challenge cup is ready for the competing designers and model owners of the United Kingdom, and the various clubs are about to hold a general meeting to draw up rules for the government of the cup regattas Naval men are especially interested in the exhibitions. At the regatta, which was the subject of the accompanying pictures, Lieutenant William Barrett, R.N., attended with a party of naval cadets and rendered many services to the committee

Cost of 20,000 Candle-Power Street Lighting Plant.

BY ALTON D ADAMS

As tungsten lamps require only 36 per cent as much energy as the carbon type for equal illumination, they have greatly reduced the cost per candle-power of incandescent street lighting.

What can be done with such lighting in a small town is illustrated by the following costs and operating expenses for a plant to generate and distribute tungsten street lamps of 20,000 candle-power total.

Unlike the merely nominal rating of arc lamps, which are a number of times their true candle-power, the tungsten lamps are rated at their actual mean candle-power in horizontal directions.

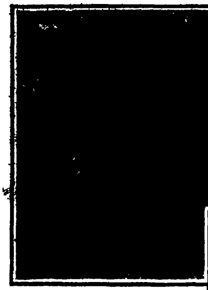
The capacity of 20,000 candle-power is selected as nearly suited for street lighting in many medium and small towns, according to the density of illumination required. If lamps of 40 candle-power are selected the capacity named amounts to 500, and with lamps of 80 candle-power the 20,000 candle-power capacity will operate 250, the efficiency being the same in either case.

With 500 of the 40-candle lamps spaced 100 feet apart, or 250 of the 80-candle lamps 200 feet apart, 50,000 feet in length of streets may be lighted much better than is usual in small places, while ordinary results may be obtained by spacing the 40-candle lamps 200 feet apart or the 80-candle 400 feet apart from 100,000 feet, or 19 miles, of streets.

In the following estimates of the first cost and operating expenses of a 20,000 candle-power plant, it is assumed that each part of the equipment, from the generators to the poles, is used merely for the purpose of street lighting, so that both the first and operating expenses for this lighting are greater than they would

ful in connection with commercial service under like conditions.

The estimate of first cost covers a suitable plot of land, a station building of brick, concrete and steel, a storage tank to receive petroleum by the carload, a crude-oil engine and accessories, an electric generator with all necessary apparatus and instruments, pole lines on 56 000 feet of streets, circuits on these poles for the distribution of tungsten lamps of 20,000 aggregate candle-power in any desired sizes and fixtures on the poles for 500 of these lamps all erected and connected complete and ready to operate.



View of the lake, showing the start of a race.

For this 20 000 candle-power plant as above with 500 lamp fixtures erected the total first cost is $14 200 or 71 cents per candle-power capacity giving $28 40 per 40-candle lamp. This cost of plant is based on present market prices of materials labor and apparatus and assumes ordinary conditions at the place of erection. In places where prices and freight rates are higher than is usual in the eastern half of the United States an increase of cost would result.

Operating expenses of the above plant will vary with the number of lamps used even though the total candle-power remains at 20 000 because of the cost of lamp renewals and also with the hours that the lamps burn yearly.

All night and every night lighting to the extent of 4 000 hours per year is the most desirable and costs less per hour than lighting on moon and other schedules that run down as low as 1 500 hours yearly. Such all night and every night lighting is gradually displacing the short hour service and the following estimate of operating expenses is for lamps burning 4 000 hours per annum. With 500 street lamps of 40 candles each making up the total 20 000 candle-power capacity of the above plant and burning 4 000 hours the annual expense of operation would be $6 200 including $710 for interest on the first cost of $14 200 at 5 per cent. This expense of $6 200 covers all depreciation of the plant as well as the operating expenses that involve an immediate outlay of cash. Apart from the interest charge the annual expense of operating the 500 lamps of 40 candle-power each during 4 000 hours yearly is thus $5 490. The total expense of $6 200, including interest amounts to $12 40 yearly for each of the 40-candle lamps burned 4 000 hours, or to 0 31 cent per lamp hour of burning. As each 40-candle tungsten lamp operates with 50 watts, the expense of 0 31 cent per lamp hour, including interest, amounts to 6 2 cents per kilowatt hour consumed in the lamp.

The same conclusion is reached by considering that at the efficiency of 1 25 watts per candle-power the production of 20,000 candle-power requires the delivery of 25,000 watts at the lamps and this during 4 000 hours amounts to 100 000 kilowatt hours, which into the annual expense of $6 200 gives 6 2 cents as before.

The "Minnehaha" being taken out for her trial.

The Coalinga Oil District, California.

A report on the geology and oil resources of the Coalinga oil district in the western part of Fresno and Kings counties California by Ralph Arnold and Robert Anderson has just been published by the United States Geological Survey as Bulletin 398.

The district described which is about 15 miles wide and 50 miles long stretches along the northeast base of the Diablo Range and includes a band of productive oil land 3 miles wide and 13 miles long at its north end and a narrow strip of oil land along its southwestern boundary.

The region includes about 550 producing wells which range in depth from 600 to 4 000 feet and penetrate from 20 to 200 feet of oil sand. The product ranges from a black oil of 15 deg Baumé to a green oil of 3[illegible] deg Baumé. The yield of single wells differs greatly ranging from 3 to 3 000 barrels a day.

The district is the leading producer in California and one of the most productive in the world. Its production in 1907 was 8 871 723 barrels in 1908 it was 10 386 168 barrels, and in 1909 it was probably 1[illegible] 200 000 barrels or more.

The total quantity of oil thus far taken from the ground in the district to the end of 1909 was about 63 000 000 barrels of 42 gallons each leaving available a vast store of oil which has been roughly estimated as 2 747 000 000 barrels. Even if this great quantity of oil is in the ground it is not possible to state whether all of it can ever be obtained.

Pipe lines connect the district with the seaboard at Monterey 110 miles away with San Francisco Bay 200 miles away and with other points.

The report describes the topography geology paleontology and oil in the Coalinga district which have been in part described in an earlier report published by the Survey but not now obtainable. The present report includes a more complete discussion of the district and many new maps sections and other illustrations besides a paper by Irving C Allen on the chemical and physical properties of the oils. Many interesting points in connection with the history of the region in past geologic ages are brought out and by means of careful descriptions of the formations a foundation is laid both for an accurate study of the occurrence of oil within this region and for the tracing of formations and oil horizons in other parts of California.

The report covers 354 pages and includes 52 plates and 3 text figures. The characteristic fossils of the rocks of the region are fully illustrated. These afford a means of identifying particular strata from place to place and of determining the depth and position of the oil bearing sands. The discussions of the oil zones of the factors affecting the accumulation and the gravity of the oil of the relations of oil and water and of the origin of the oil are of broad general interest. The maps and diagrams and the detailed accounts of the geology of the wells and the character of their various products are of decidedly practical immediate value.

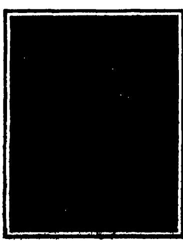
Bulletin 398 may be obtained without cost by applying to the Director of the Survey at Washington.

The Current Supplement.

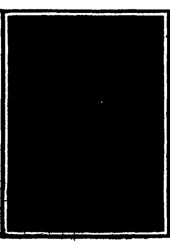
The opening article of the current SUPPLEMENT No 1790 deals with electrochemical action and boiler corrosion. There is often much loose thinking and loose talking concerning the stability of ocean-going steamers among those who ought to be better informed than comments made sometimes seem to indicate. The matter is set right in an excellent article entitled Stability of Ships. Edward Person gives some interesting cam constructions. Tunnels in Being and Tunnels to Come is the title of an article which gives much useful information. Richard Thirsk contributes an instructive account of the German army and shows how wonderful the military system of Germany is. John L Cowan contributes a good article on The Story of Silk accompanied by many excellent photographs.

The "Sunny Jim" makes a great pace.

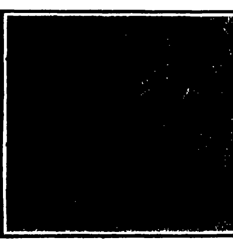
The newspapers recently published articles on the discovery of what was pronounced to be the greatest radium vein ever discovered in the United States in Leonia Lincoln County Montana. Inquiry of the Geological Survey reveals the fact that there is very little if any truth in the statements made.



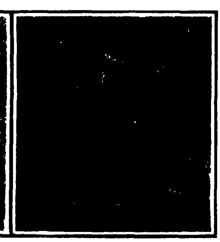
"Meraima," model of a steam ocean liner.



"Fairholme," an electric liner model.



"Belvedere II," a gasoline model.



"Lusus," a gasoline craft. Note the heavy wake.

MODEL MOTOR-BOAT RACING.

ROUGIER'S SPECTACULAR MONACO FLIGHTS

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN

A year ago, despite the offering of substantial prizes for flights across the Bay of Monaco, no aviator made the attempt This year however, such big strides have been made in the art of flight that there are probably a score of aviators who are willing to try a flight over water, even without any special arrangements being made for landing in this element in case they are forced to do this

With the spectacular flights of Paulhan and Charles K Hamilton over the Pacific Ocean last January as an example, Rougier, a famous French cyclist and automobilist who has lately joined the flying ranks early last month made some thrilling flights above Monaco Bay photographs of which we reproduce

The first flight of an aeroplane over Monaco Bay was made on March 3rd Starting from the quay, Rougier described a figure eight above the bay and flew over Cape Martin at a height of 250 feet He landed safely at his starting point after a flight of 4¼ minutes

Rougier's second flight above the bay was made on the 6th ultimo in the presence of the Prince of Monaco and a large number of spectators This and the flight the next day were each from 5 to 10 minutes' duration On the 7th he passed 100 feet above the line of fortifications as shown in our front-page illustration, and flew straight across the bay, attaining a height of 1,300 feet above Cape Martin Despite some rather strong wind gusts the biplane flew with steadiness and without tipping dangerously On his way back to the starting point Rougier performed evolutions above the casino of Monte Carlo at a height of 300 feet Finally he flew back to the rock of Monaco and landed with precision upon the narrow quay

On March 8th he again started from the quay of the port, and flew straight for Cape Martin, across the bay He rose to a height of 600 feet described a circle above the bay passed over the rocky shore at Monaco and landed at his exact starting point after a 10-minute flight. The next day he made his longest and most spectacular flight. Starting at 5 10 P M, he rose rapidly, and described a circle above the sea Returning he made two more circles above the Casino Then, still rising, he flew above Mont Egel (elevation 2 625 feet) Passing over the summit, he flew to La Turbie where he turned at a height of 300 feet, and flew back to his starting point The length of this flight was 28 minutes and 34 seconds. On March 10th Rougier again flew around the Bay of Monaco and on the 17th he made another fine flight of a quarter of an hour in the course of which he passed 600 feet above Cape Martin following the rocky shore of the coast in returning These flights of Rougier on his Voisin biplane demonstrate that a considerable degree of automatic stability can be attained by vertical partitions between the main planes, and quite discredit the cabled report just received from France to the effect that the Voisin brothers have given up as impractical their system of inherent automatic stability, and have adopted wing warping instead

Rougier flying over the yachts in the Bay of Monaco in his Voisin biplane.

THE AVIATOR FLEW OVER MONT EGEL (ELEVATION 2625 FEET), AND THRILLED MONACO FOR TWO WEEKS.

Aeronautic News at Home and Abroad.

LE BLON'S FATAL ACCIDENT

Besides the record flights by Rougier above Monaco Bay, Le Blon, another famous automobile racing driver who has been flying a Blériot monoplane, made a wonderful flight above the Bay of San Sebastian, Spain, on the 2nd instant He started in a high wind, and made several circles above the bay at a height of 150 feet, when suddenly the monoplane turned upside down, and fell into the shallow water The intrepid aviator was instantly killed His machine, like that of the ill-fated Delagrange was fitted with a Gnome revolving cylinder motor of 50 horse-power The excessive power and the gyroscopic action of the motor undoubtedly had something to do with both of these fatal accidents. Le Blon made a speed record of 46 19 miles an hour (5 kilometers in 4 minutes 2 seconds) at the Heliopolis aviation meeting near Cairo last January

ACCIDENT TO A CURTISS BIPLANE.

While flying in a Curtiss biplane above San Francisco Bay at Alameda, Cal, on the 5th instant Frank Johnson plunged into the water from a height of 80 feet owing to his losing control of the machine Fortunately he was uninjured, and was able to extricate himself from the aeroplane (which was not badly damaged) and to swim toward the shore He was rescued by men in a skiff

FIRST TEST OF PARSEVAL MONOPLANE.

The first test of Major von Parseval's large monoplane occurred on the 14th instant above Lake Plau, in Germany This machine has a spread and length of 45 feet, and is fitted with a 120-horse-power 4-cylinder motor The trial flights were made in a violent and gusty wind with two men in the machine The monoplane capsized, and fell into the lake The two engineers, Hoff and Blochman, were rescued This machine is provided with both wheels and floats, but whether or not it started from the water is not known as yet.

FLIGHT OF THE FABRE HYDRO-AEROPLANE.

Credit for producing the first aeroplane to rise from water and fly must apparently be given to M Henri Fabre, who, according to the French journal L'Aero, succeeded in getting his combined hydroplane and aeroplane to leave the water and make several flights 1,200 to 1,500 feet in length at heights of from 6 to 10 feet he experiments were made at the Port de la Mède at Martigues, a city near Marseilles. The first successful flight from water was made on March 31st.

NEW RECORDS OF FLIGHT WITH PASSENGERS.

On the 5th ultimo Henry Farman broke all records of flight with one or more passengers by carrying Mr Hevardson, of the Daily Mail, and Mme Frank for 1 hour, 2 minutes and 25 seconds. The performance was accomplished with a new and smaller biplane than he has been in the habit of using. Just a month later, on the 8th instant, Daniel Kinet, a Belgian, broke the world's record for flight with one passenger by flying 2 hours and 20 minutes at Chalons. This record was also made with a Farman machine.

A NEW CROSS-COUNTRY RECORD.

Emile Dubonnet, on April 3rd, won the 100-kilometer (62-mile) cross-country flight prize offered by La Nature He made a fine flight from Savigny-sur-Orge to Ferté-St Aubin (about 68 miles) in 1 hour and 50 minutes

EFFECT OF A PROPELLER BREAKING IN FLIGHT.

While practising at Pau with his Blériot monoplane on the 26th ultimo, Leblanc had a narrow escape. He was at an estimated height of 900 feet when his propeller broke and flew off. Quickly stopping his motor, Leblanc skillfully glided to earth amid the cheers of the spectators.

The Ascent of Mount McKinley.

Three months ago, a party headed by Thomas Lloyd left Fairbanks, Alaska, for the purpose of climbing Mount McKinley The summit was reached on April 3rd, after a month of steady climbing A camp was established at the base of the peak in March. The companions of Thomas Lloyd were W R. Taylor, Charles McGonigle, and Daniel Patterson Six other men were also included in the party, but they were left in care of the four camps established on the way toward the top of the peak. Up to 12,000 feet the ascent was easy, but the next 4,000 feet were climbed only by hewing steps out of solid ice When the 16,000-foot level was reached, a final push was made by the four men named, with success. The expedition had its inception in the violent controversy which raged when Dr Cook was lecturing To settle the point whether or not he ever climbed the mountain, and to prove that it could be done, an expedition was financed by August Peterson and William McPhee.

No trace of Dr Cook's ascent could be found on either of the two peaks which constitute Mount McKinley No records of his were discovered

Various estimates have been made of the mountain's height. W A Dickey, an American prospector, estimated it at 20,000 feet, and gave the peak its present name. Robert Dunn, who made four attempts to climb the peak, estimated its height at 20,300 feet.

Inasmuch as the present party was not properly equipped to measure the height of the mountain, its achievement is not of much scientific value Fortunately Prof. Herschel C Parker of Columbia University has expressed his intention of climbing the peak regardless of Lloyd's success. Dr Parker will approach the peak from the southern side, and will study the glacier and various phenomena. He will take with him scientific instruments, by the skillful use of which undoubtedly more information will be obtained than could be secured by a party of four unscientific but hardy explorers.

Barril, the guide who exposed Cook, is inclined to dispute Lloyd's claim

A New Way of Lighting Stages.

A new system of electric lighting for theater scenes was tried not long since at the Imperial Opera of Berlin, and, it is stated, with great success. It is the invention of the Spanish engineer, Fortuny, and uses an arc lamp as the source of light. The rays of the lamp, instead of falling directly on the scene, are thrown against a series of silk bands which are unrolled and set in any position by means of pulleys. The bands serve to reflect the light and change it into a perfectly diffused light. The new method also includes a sky which is formed in a quarter of a sphere and composed of a steel cap which is treated with a dead white coating The diffused light is sent into this dome and gives the illusion of an unlimited space. Another interesting device is used to dispense with the ordinary clouds which always have a rigid appearance to the audience. These now appear to be quite plastic and mobile. Such result is secured by the use of mirrors which reflect painted screens representing the clouds. When the mirrors are rotated slowly, the clouds appear to slowly move over the sky. All the present system is worked from four small cabins which are placed in the auditorium. Competent persons are of the opinion that the present invention forms a considerable progress from an artistic as well as a technical and economical standpoint.

An Automatic Projecting Lantern with Electrical Control

BY JACQUES BOYER

Hitherto it has been necessary for a lecturer using lantern illustrations to employ an assistant to operate the lantern and insert each slide at the proper moment. M. Moulin has invented an automatic lantern (Fig. 1) which dispenses with the services of the assistant. The ingenious mechanism which inserts and removes the slides can be adapted to any projecting lantern and enables the lecturer, by pressing an electric button on the platform, to show any picture at will. The invention will be especially serviceable to teachers, as is shown by Fig. 4. The pictures can be thrown on the white wall of the class room, and if a powerful source of light is employed it will not be necessary to darken the room to an extent sufficient to prevent the taking of notes or the use of the blackboard.

The lantern slides are attached to a conveyor, composed of two chains connected by grooved cross-bars, which pass over a skeleton drum, formed of two iron disks connected by six rods. Each slide is firmly held between a fixed and a movable bar of the conveyor by

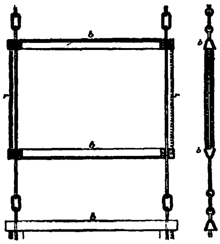


Fig. 2.—Front and side views of chains carrying slide holders.

the tension of the spring r (Fig. 2). The drum is turned by a small electric motor, by means of a tangent screw, and, as it rotates, the slides are brought successively opposite the projecting lens. In this operation the flexible conveyor carrying the slides is taken up from a box behind the drum and delivered to a receiving box beneath the lantern.

The motor is shunt wound, so that it can be reversed by reversing the current in the armature coils. In this way a slide which has already passed the lens can be brought back and projected again, if desired. The electrical connections by means of which the apparatus is controlled are shown diagrammatically in Fig. 3. Beneath the lecture table is a switch I, the closure of which sends a current through the electric arc A of the projecting lantern, and also through the field coils S of the motor, which are connected in parallel with the circuit containing the arc and its rheostat. On the table are two double contact keys a and a'. The upper contacts of these keys, 1 and 1', are connected with one wire of the general circuit, the lower contacts, 2 and 2', are connected with the other wire, and the fixed ends of the keys are connected, respectively, with the two brushes of the commutator attached to the rotor or armature R of the electric motor. Hence, when neither key is depressed, both brushes are in connection with the same main wire, and no current flows through the rotor R, which consequently remains motionless. By pressing the key a, the current is sent through the rotor circuit in the direction indicated by the arrows, and by releasing a and depressing a' the current and the rotation of the motor are reversed. The incandescent lamps L and L' are bridged on the

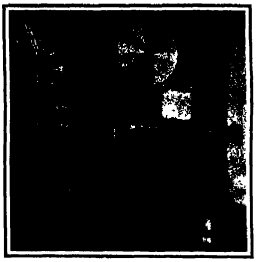


Fig. 1.—An automatic projecting lantern.

keys to diminish sparking, but they also serve another useful purpose. When the key a is partially depressed, so that it does not touch either contact, the rotor circuit is completed through the lamp L, which greatly increases the resistance of the circuit, and the current flowing through the rotor is further diminished by more than one-half by the shunt effect of the lamp L'. Hence, the motor turns so slowly that it is an easy matter to stop the desired slide exactly in front of the lens, by releasing the key a at the proper moment. Neither of these effects is produced when the key a is fully depressed, because the lamp L is then short circuited by the key and the resistance of the circuit is thus made so small that very little current is diverted through the other lamp. A slow movement of the motor and the slides in the reverse direction is similarly produced by partially depressing the key b.

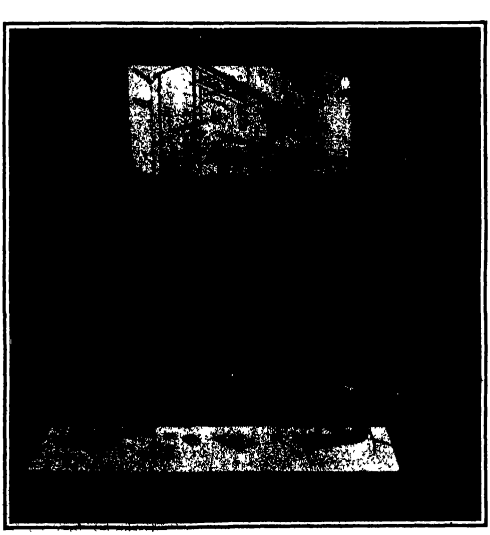


Fig. 4.—A lecture illustrated by the automatic projector, controlled by the lecturer himself.

AN AUTOMATIC APPARATUS FOR PROJECTING PICTURES.

Tides at Panama.

The average time of high water at places on the Pacific coast of the Central American isthmus is three hours after the moon's meridian passage at Panama. The average time of high water at Colon is six minutes, and at Greytown one hour after the moon's meridian passage at Colon. In other words, as Colon and Panama are nearly on the same meridian, it may be stated that high tide will occur at the Pacific or Panama end of the Panama Canal, on the average two hours and fifty-four minutes after high tide at the Atlantic or Colon end, and high tide will occur at the Pacific or Brito end of the Nicaragua Canal route two hours after high tide at the Atlantic or Greytown end.

The level of mean tide is practically the same at both ends of both of these isthmian canal routes, but at Panama the tide ranges from 10 feet above to 10 feet below mean sea level, while at Colon it only ranges from 6 or 8 inches above to 6 or 8 inches below

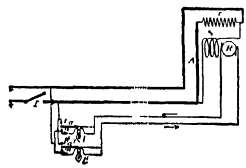


Fig. 3.—Electric wiring for automatic projector.

mean sea level, and at Brito or San Juan del Sur the tide ranges in the extreme from 4 feet above to 5 feet below mean sea level, while at Greytown it ranges less than 5 inches above and below mean sea level.

Thus with a sea level canal built along either the Nicaragua or the Panama route, there would be through currents from the Pacific to the Atlantic at the times of high tides at the Pacific termini, and from the Atlantic to the Pacific at the times of low tide at the Pacific termini.

In answer to the specific question: "Assuming that the Pacific tide rises about 8 feet, suppose it to be high tide at San Juan del Sur, Nicaragua, at noon standard time, what would be the approximate difference in level of the Atlantic at the same time, say at Greytown, Nicaragua?" it may be stated that at the time of high tide at San Juan del Sur it is two hours after high tide at Greytown, and if the assumed rise of 8 feet at San Juan del Sur is above mean sea level the difference in level between the two ends of the canal would be about 7¾ feet.

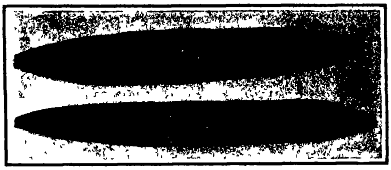
To secure accurate information with reference to the weather conditions Dr. William Shaw, Director of the Meteorological Office of Great Britain, has been traveling in western Canada. With reference to the alleged general changes in the climate owing to the settlement of the country, Dr. Shaw is skeptical. He states that he has observed that the people of all localities are under the impression that the climate of their district is undergoing a change. The statistics do not, however, bear out this idea. There are oscillations but no permanent changes in the climate.

INSECT PESTS IN HOUSE AND STORE

BY HAROLD BASTIN

Insects as a class feed literally upon anything and everything from which nourishment may be extracted by dint of strong jaws backed up by equally strong digestions A substance may be 'bone dry, almost as hard as rock and in every way uninviting, yet so long as its origin is traceable to the animal or vegetable kingdom at least one insect probably very many kinds will find in it the wherewithal of existence And because they are omnivorous in the fullest sense of the word, insects rank as the worst pests with which civilized man has to contend whether his calling be that of a producer or a disseminator of the necessaries and luxuries of life Much has been written respecting the depredations of insects Everyone will probably know something at least of the tax which has been imposed upon the exchequer of this country by such insects as the Colorado beetle and the "scale" of the orange groves But it is with certain pests which while less devastating in their activities, affect closely the individual comfort of our readers that the writer proposes briefly to deal in this place Probably few people realize what a number of insect pests are to be found in the ordinary house or larder Insects penetrate the very fabric or our dwelling places —that is, so far as the woodwork is concerned They burrow into our furniture and our books, and consume by slow degrees the very carpets on our floors and the clothing in our closets and presses

Among the most widely distributed of these domestic pests are certain tiny beetles of the genus *Anobium* Their ancestral home was in the woods and lanes where they are still abundantly represented, frequenting the dead branches of trees and shrubs. They have, however forced an entry into almost every old house in the land, as well as into many a modern dwelling, where they accomplish considerable mischief by boring into and consuming furniture, beams and woodwork in general This successful assault of our houses must have been accomplished many centuries ago, for one of the commonest species was dubbed '*domesticum*' by the old naturalists and is so called at the present day This insect is barely one-sixth of an inch in length, gray brown in color, cylindrical in shape, with its head hidden in, or overhung by, the thorax The tiny grubs are soft-bodied, with hard heads and—as their work bears witness—powerful jaws It is not difficult to detect the presence of these grubs in woodwork Suppose that you have a valuable Chippendale chair, and that you notice beneath it upon the floor, certain little heaps of yellowish dust Inspection of the chair itself reveals minute holes scattered about the surface of the woodwork—much as though the piece of furniture had been "peppered" from a distance with a charge of dust-shot. These signs are indisputable evidence that your chair is beetle-riddled, and unless by some means you can contrive to dislodge the pests, they will slowly but surely reduce the woodwork to dust and chips



Cigars damaged by the tobacco beetle.

When once a piece of furniture is assailed by *Anobium*, it is a very difficult matter to eradicate the pest. Several methods have been suggested One plan is to place the piece of furniture in a refrigerating chamber for a week or two, and thus attempt to kill the beetles and their grubs by cold It is somewhat doubtful, however, whether even this severe ordeal will destroy all the beetles Another way, and probably a more effectual one, is to place the furniture—first taking it to pieces if necessary—in a hot chamber or oven, and there bake it for twenty four hours or more If the temperature be kept a little above that of boiling water, not a single beetle will be alive when the baking is over. Often it would be impossible to adopt either of these methods, and in such cases the best plan is first to place the piece of furniture in a very hot room for some hours, then to inject, by means of a very fine-nosed syringe, a poisonous liquid—such as creosote or cyanide of potassium—into as many of the tiny "worm holes" as can be found on the surface. Then remove the furniture at once to a cold place, when the sudden change of temperature will cause the poisonous fumes to be drawn into the innermost recesses of the burrows. Finally, the holes on the surface should be stopped up with paraffin wax

Dust from the borings of the cork-caterpillar on a bottle-neck

Wine bottle cork showing the burrowings of the cork-caterpillar

The various species of *Anobium*, and their bigger relatives of the genus *Xestobium*, by no means confine their attacks to furniture The whole woodwork of old houses has been so completely riddled by their borings as to render the structures unsafe. Indeed, a beam that has been tenanted by these insects for a number of years is little better than an outer shell containing a mass of wood-dust. A photograph showing damage done to woodwork is here reproduced *Xestobium*, by the way, is the common "death-watch," while *Anobium* also is in the habit of making a tapping sound The nocturnal tapping of these insects, distinctly audible in a room where there is an otherwise complete absence of noise, has for many centuries been regarded by the superstitious as a warning of the approach of death. This uncanny interpretation of a mysterious sound is scarcely surprising when we remember that only in recent years have naturalists discovered its true cause The little beetle has been found in some secluded spot, jerking its hard head at regular intervals upon the surface of the wood beneath it. So far as can be told, its rappings constitute a kind of courtship ritual Obviously they have no connection with the latter end of mankind So that the old "death-watch" theory has been exploded!

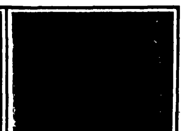
While speaking of these bettles, the writer may mention another insect known as the "book-louse." It is very minute, soft, and wingless. Its color is that of pale amber, while it is not distantly related to the "white ants" of tropical countries *Atropus divinatoria*, to give the book louse its scientific name, is very common in old houses, especially if they are damp As its popular name indicates, it may be found among old books and manuscripts, where it seems to browse upon the surface of the paper It has also been known to damage collections of dried plants and in-

(*Continued on page 348.*)

An apple (cut in halves) which has been the home of a caterpillar of the codlin-moth.

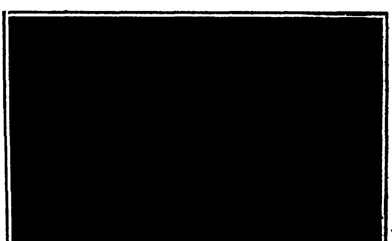
Ginger root attacked by the paste beetle,

Cigarettes damaged by the tobacco beetle,

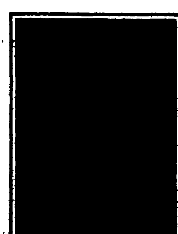


A book showing the ravages of the "book worm,"

Old Java coffee beans showing the borings of a beetle.



Macaroni attacked by the paste beetle.



Grains of wheat (magnified) which have been eaten into by the corn weevil.

INSECT PESTS IN HOUSE AND STORE.

Patent Department

FIRE-PROOF CONSTRUCTION AND OUR ANNUAL FIRE LOSS.

It is estimated that our annual fire loss, and the sum expended for fire protection, etc., represent an annual sum that is approximately equal to the cost of building the Panama Canal The public is awakening to the economic significance of this fact, and business men generally are beginning to realize that the best way to guard themselves against the fire peril is, not so much to institute elaborate means for extinguishing fires and burden themselves with heavy insurance, as to so erect their buildings that it will be difficult for a serious fire to originate, and, if it does, impossible for it to obtain a serious hold upon the building The growth in favor of fireproof construction has been indirectly stimulated by the growing price of lumber, the advance having been so great that for some forms of construction there is but little extra initial cost involved in putting up strictly fireproof construction. Indeed, from an investment standpoint it can be demonstrated that the fireproof building is the only really economical building The saving in the cost of insurance, reduction in depreciation charges, the guarantee against interruption of business by fire, combine to make an unburnable building the cheapest in the long run

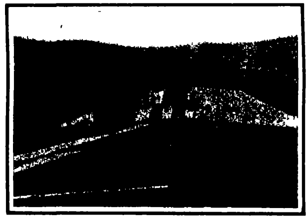
The phenomenal development in reinforced concrete construction must be regarded as one of the most significant movements in the broad field of architecture and engineering It is not too much to claim that the lion's share of improvements in this direction is to be credited to American engineers The experimental work on sample structural members, and especially upon beams and columns, has led to a pretty thorough knowledge of the true principles of construction to be adopted for reinforced concrete when used in such members, and the introduction of a reinforcement designed to adequately take up the shearing strains, as supplied for instance in the Kahn system, has made it possible to produce beams, girders, stringers, and other members subject to bending stresses, whose strength can be determined with dependable accuracy.

Side by side with the development of reinforced concrete members, such as are suitable to what might be called the skeleton frame of concrete building, much experimental work has been done in producing a suitable form of walling or paneling, for filling in the broad open surface represented by the wall spaces, the floors and the roofing. In the accompanying illustrations we show what is known as the Hy-Rib method of steel sheathing, which is an interesting case of development along this line. It consists of a special steel lath stiffened by rigid high ribs, both the ribs and the lath being made from the same sheet of steel The object of the ribs is to give sufficient stiffness and rigidity to the lath, so that when used in walls and partitions no studs, such as are required by the ordinary plain lath, will be necessary When it is used as reinforcement for floor and roof slabs, no wood centering or falsework is required, for the ribs give the required stiffness. If this sheathing is used for partitions, it is merely necessary to provide a fastening at the floor and the ceiling. The sheets are then set in place and the plaster applied directly to both sides.

For sidings of factories and similar one and two-story buildings, a framework of steel or concrete is provided to which the sheets are attached Lines of supports are provided, about six feet apart and the Hy Rib is properly fastened to them The framework is similar to that which would be provided where the ordinary wood sheathing or corrugated iron is used, except that the girts can be placed a greater distance apart. When the steel has been properly placed a special stucco plaster is applied in two coats

Where the system is used in connection with floors and roofs, supports are ordinarily provided about five feet apart. The sheets are laid directly over the supports with the lath face downward All that is necessary to complete the work is to put in the concrete on the upper sides of the sheets to the required thickness. Only a sufficient amount of concrete will flow through to give a thorough clinch on the steel This leaves a roughened surface on the underside, which provides a satisfactory key for the plaster applied on the ceiling below By use of reinforcing materials similar to this, nearly every type of building no matter how small, may be built fireproof at a cost very little greater than the ordinary wood framing

Applying the plaster to a rib-stiffened steel lath and plaster partition.

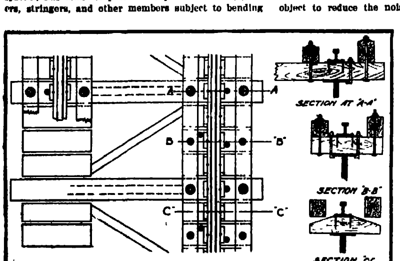


Building a roof of reinforced concrete construction.

FIRE-PROOF CONSTRUCTION

IMPROVED ELEVATED RAILWAY CONSTRUCTION

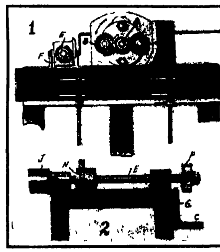
The combination cross tie and "block" the construction shown in the accompanying drawing has for its object to reduce the noise of elevated railroads and increase the light to the street below An open construction is provided yet the rails have an almost continuous support which tends to absorb and stop the vibration sent out from the rails. Most of the noise from a train on an elevated structure is due to the passage of the wheels over the rail joints and there is no doubt that this noise is intensified by the inefficient support of the rails at such points. Should the three "block" ties be removed, letting the rail free of support, and a wheel be rolled over the rail, the vibrating noise would be very great By inserting "block" ties between, this noise is decreased in proportion to the number of ties inserted until when a continuous support is made the noise is reduced to a minimum It is but natural for engineers to copy precedents, and for this reason the usual system of cross ties, which, by a process of evolution, has been found most satisfactory for a road constructed on the ground has been adopted for elevated railroads, with the result that an excessive amount of noise is produced whenever a train passes over the rails, and the street is unnecessarily darkened by the multiplicity of cross ties This proposed system of building an elevated railroad has been suggested by Mr Carl R. Klok, of 1243 Columbia Avenue, Chicago, Ill.



IMPROVED ELEVATED RAILWAY CONSTRUCTION

ATTACHMENT FOR WOODWORKING MACHINES.

The accompanying engraving illustrates an attachment for woodworking machines generally known as molders or stickers used in sash and door factories for cutting rabbets and moldings in the parts to receive the panels. When a door is to be provided with a pane of glass, it is usually necessary to cut away the molding or rabbet at one side so that the glass can be inserted when the door is completed and be held in position in the usual manner by means of putty In order to avoid a second operation to cut away the molding for this purpose the auxiliary cutter shown in the accompanying engraving is provided The auxiliary cutter is arranged to be moved axially into and out of operative position, so that when it is no longer desired to cut away the molding the operation of the auxiliary cutter can be stopped In Fig 1, which shows a face view of the machine the main shaft is shown at A and mounted upon it is the main cutter head, provided with the cutters B which form the rabbet and molding Immediately in front of the cutter head is a table C on which the work is supported and a pair of guides D for holding the work in position The auxiliary cutter is mounted on a shaft E It consists preferably of a square cutter head provided with a pair of blades F Fig 2 shows a side view of the auxiliary cutter moved to inoperative position so that it clears the work G supported on the table C The shaft of the auxiliary cutter is provided with a yoke and collar H by which it may be moved axially so as to bring the cutter into engagement with the work G The driving pulley of the shaft E is shown at J The inventor of this attachment is Mr A C Tippett of 1283 Franklin Avenue Astoria Oregon

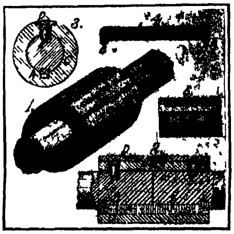


ATTACHMENT FOR WOODWORKING MACHINES

SHAFT COUPLING

Pictured in the accompanying engraving is an improved coupling of the type adapted for connecting the abutting ends of two revoluble shafts Briefly the device consists of a key and a sleeve which serves to hold the key in place while a second locking key serves to retain the sleeve in position over the two shafts As shown more clearly in the sectional view Fig 2 and in Fig 5, a keyway is cut in each shaft, and a pit or recess is formed at the end of the keyway The shafts are turned so that the two keyways are in alignment and then a key of the form shown in Fig 4, and indicated at A in Fig 2 is fitted into the keyway The key is provided with lugs at the end adapted to fit into the pits of the keyways Before bringing the shafts together, a sleeve C is fitted over one of them This sleeve as shown in the cross-sectional view, Fig 3 is formed with a keyway adapted to fit over the key A when it is moved over the abutting ends of the shafts To hold the sleeve in position, the key D is used This fits into an exterior keyway in the sleeve C and is provided with a pair of lugs E which pass through the sleeve and into the two shafts A screw F serves to hold the key D to the sleeve C In this manner the two shafts are rigidly connected Owing to the large

diameter and massive construction of the sleeve C and owing to the manner in which the two keys are interlocked the coupling has a strength equal to that of any portion of either shaft When the shafts are coupled they are in line with each other and it is impossible to turn one shaft relatively to the other except by a force sufficient to mutilate them to a considerable extent A patent on this coupling has



A STRONG SHAFT COUPLING

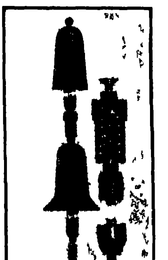
been secured by Mr William F Baum of 2802 Cedar Street Philadelphia Pa

A NEW SYSTEM FOR HIGH TENSION INSULATION

A patent recently issued to Louis Steinberger of Brooklyn N Y covers a novel and improved system of insulation for high potential electric conductors to be used in various relations and for various purposes such as power transmission and for guy wires or cables employed as stays for towers or poles masts and other supports used in wireless telegraphy and telephony as well as in regular commercial work It marks a radical departure in the development of insulator systems

The system comprehends a series of insulators preferably of a thimble type and a series of other insulators of a rod type the thimble type insulators being alternated with the rod type insulators and together therewith forming a flexible chain of parts which may be extended indefinitely

The under surface of the thimble type insulators will be of course at all times comparatively dry Each thimble type insulator acts like an umbrella covering the upper end of the rod type insulator below it and connected therewith thereby keeping it dry under the most unfavorable conditions (as for instance when all the insulators are subjected to the action of a driving rain) hence the group of insulators must always afford adequate insulation for all practical purposes



A NEW SYSTEM OF HIGH-TENSION INSULATION

This system will practically prevent leakage and undesirable grounding of the current either from conductors or from supporting structures for the same

In this system the various parts may be readily detached and replaced by other parts and the total number of parts may be increased or diminished at will after the original structure is built this feature being especially important in instances where after the installation of a conductor the voltage is to be increased

Not the least important feature of the system is the flexibility of the chain of units and that the structure as a whole when in operation is under spring tension thereby insuring a certain elasticity so that the complete structure is relieved in all of its parts as well as in its entirety from the effects of sudden and abrupt accidental strains usually so destructive to mechanism of this kind

SIMPLE LETTER SCALE.

An inventor has recently struck upon the simple idea of using coins to weigh letters, so that the value of the coin will represent the value of the stamp that must be applied to the letter A simple beam scale is used provided at one end with a clip for holding the letter and at the other end with a clip for holding the coins If the scale is to be used for first-class mail the rates for which are two cents an ounce the fulcrum of the scale is so placed that a letter weighing an ounce would be just counterbalanced by two one-cent coins in the other clip As shown in our illustration the scale beam is made of sheet metal bent to channel form with the ends turned over and terminating in knife-edged pivots on which the letter and coin clips are suspended A detail of one of these clips is shown in Fig 2 It is made of a single piece of metal bent to form two jaws which may be roughened or crimped to provide a better gripping surface At the upper end of the clip are two ears bent upward and provided with apertures to receive the pivots of the scale beam A bail shaped handle serves as a fulcrum for the scale In order to adjust the scale accurately a metal poise is provided on the under side of the scale beam The scale beam is formed of two ears which pass through a slot in the poise and are bent back upon it to hold it in place as indicated in Fig 3 The poise may be delicately adjusted to bring the scale to a correct balance The inventor of this ingenious letter scale is Mr Willis J Fink, of Elk Point South Dakota

INLET VALVE AND SCREEN FOR PUMPS

The device which is illustrated in the accompanying engraving is adapted particularly for use in con-

SIMPLE LETTER SCALE

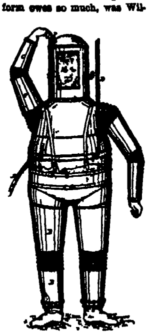
nection with water pumps in boats the object being to strain the water that is drawn in by the pump The strainer is provided with a special attachment whereby it may be cleansed instantly while the valve is in service The body of the valve is indicated at A in the illustrations and is provided with a branch B whereby it may be connected with the pump The lower portion of the body is enlarged to form a valve cage C Screwed to the cage is an extension member D which at its lower end is formed with a screen E A valve seat plate F is secured in the chamber C and upon it rests the valve G Lugs H in the top of the chamber C serve to limit the upward lift of the valve G Passing centrally through the valve and casing is a rod J which at its lower end is fitted with a pair of blades K These are adapted to be pressed against the outer

INLET VALVE AND SCREEN FOR PUMPS

surface of the screen E under tension of a coil spring L By rotating the rod J the blades K are caused to scrape the screen E, and thus remove any dirt that might clog the openings of the screen. Mr Olof H. Lillyman, of Potlatch, Idaho, has just secured a patent on this improved inlet valve and screen

THE INVENTOR OF DIVING ARMOR

Among pioneer inventors to whom the diving dress in its present perfected form owes so much, was William Hannis Taylor



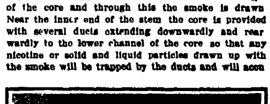
FIRST DIVING ARMOR.

The previous 'hit or miss' attempts were superseded by the Taylor patent of June 20th 1838 (No 578) in which the essential feature was the valve allowing the emission of consumed air without an influx of water Previous to this time there had been the diving chests and the diving bell of which the latter introduced by Smeaton in 1778 was the safest and most practical device for submarine exploration The diving bell has been developed along side of the diving dress and is still in use

The general appearance of Taylor's diving armor was like that of a knight's suit of mail except for a prominent bulge in the body piece A large pipe coming down from the surface and penetrating the body piece at the bulge supplied the fresh air while a short pipe entered the body piece on the other side and was provided with a valve which carried off the exhaust Although diving armor has now reached its perfected state this valve has never been materially improved upon The accompanying illustration is reproduced from Mr Taylor's patent

AN IMPROVED TOBACCO PIPE.

The principal objection to a tobacco pipe as every smoker knows lies in the fact that nicotine accumulates to such an extent as to partially clog the stem and detached particles of the distasteful drug are apt to be drawn into the mouth The saliva is also apt to flow into the stem and collect there To obviate these disagreeable features of the ordinary stem many inventions have been made designed to trap the saliva and the nicotine The accompanying engraving illustrates one of the latest inventions along this line The pipe bowl is provided with two openings one above the other and these are adapted to communicate with two channels in the stem The stem is provided with a core piece in which the channels are formed The core is indicated in the cross sectional view Fig 2 and is shown in full in the large view Fig 1 The upper channel extends the full length of the core and through this the smoke is drawn Near the inner end of the stem the core is provided with several ducts extending downwardly and rearwardly to the lower channel of the core so that any nicotine or solid and liquid particles drawn up with the smoke will be trapped by the ducts and will accu-



AN IMPROVED TOBACCO PIPE.

mulate in the lower channel It will be observed that the lower channel does not extend the full length of the core, so that it is impossible to draw any of the nicotine into the mouth At the opposite end of the core a chamber is formed in the bottom of the core piece which communicates with the smoke channel near the mouthpiece This serves to trap the saliva that may enter the smoke channel The stem of the pipe is jointed near the center so that the outer section may be removed and the core piece withdrawn for the purpose of cleansing it The inventor of this improved pipe is Mr George Bradley, of 918 Boone Avenue, Spokane, Wash.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT RACK.—G. M. Vail, New York, N. Y. This invention refers more particularly to a rack which can be folded into a compact form, which has hooks for use in supporting garments and like articles, and can be arranged in a plurality of positions, operative and inoperative, and which includes suitable means for supporting the rack from a nail or the like.

Electrical Devices.

THERMO-ELECTRIC FIRE-ALARM.—G. Blackhall, Toronto, Canada. This alarm is especially useful in buildings, such as factories or warehouses, for the purpose of giving an alarm in case of fire. It is also intended to be used in the holds of ships or in other situations where a local rise in temperature may be utilized to indicate the existence of fire.

CARBURETER AND CONTROLLER FOR INTERNAL-COMBUSTION ENGINES.—J. L. Tate, Jersey City, N. J. In the present patent the invention is particularly applicable to systems in which an internal combustion engine is employed for driving a generator and the current from the generator is used for operating a motor or for doing any other suitable form of work. Such a system is illustrated in a prior application for a patent filed by Mr. Tate.

ELECTRIC CUT-OUT.—P. T. McNally, Mandan, N. D. The invention relates to devices for operating at a distance, electric switches in branch lines of electric circuits whereby the current may be cut in or out in said branch lines either from the power house or any remote station thus controlling the current on said branch lines without cutting off the current in the main line leads.

TELEGRAPH INSTRUMENT.—W. McL. Jackson, Gastonia, N. C. The main object here is to provide means whereby the dots which are used in the ordinary Morse telegraph code, may be made by the single pressure of a key, thereby doing away with the staccato movement of the finger of the operator. Long continued use of the movement causes the finger and hand of the operator to become fatigued and often results in telegraphers' paralysis.

Of Interest to Farmers.

TREAD MOTOR.—P. W. Perras, Woodland, Wis. In this case the aim is to provide a smooth and easy running device provided with a gate which may be opened and closed to permit the ingress and egress of the draft animal and wherein the act of opening the gate will lock the wheel from movement.

MACHINE FOR GATHERING COTTON.—W. W. Poor and K. F. Campbell, Jud, Texas. The aim in this improvement is to provide features of construction for a cotton gathering machine, which enable the removal of cotton burs containing ripe cotton from the plants directly into a receptacle as the machine is moved along rows of cotton plants in a field where they have grown.

Of General Interest.

MOLD.—P. H. Allison, Torrington, Conn. This mold is for use in casting ingots such as brass bars, to be subsequently rolled into sheet or other form. It is capable of being opened and closed without taking up much floor space and arranged to prevent the formation of fins and to allow convenient and quick removal of the casting irrespective of any change in the members of the mold owing to expansion and contraction.

TRUNK PROTECTOR.—E. N. Thain, Franklin, Mass. The protector is such as used in connection with trunks, boxes and other receptacles for the protection thereof and each of which in general includes a number of corner guards adjustably connected to one another by means of tie members, whereby an upper and a lower frame are formed, and adjustable means joining the frames to hold them in position on a receptacle.

UMBRELLA.—R. L. Ruhemihl and T. Ruhemihl, New York, N. Y. An object here is to provide a folding umbrella, which can be disjointed and folded into a compact form, which takes up but very little space, which is easily manipulated both in opening and closing and folding the umbrella and which is strongly constructed so that sudden gusts of wind or the like cannot easily injure or disarrange the frame.

INDEX OR DIRECTORY.—D. T. O'Sullivan, West Orange, N. J. In the present invention the improvement has reference to indexes or directories having alphabetically arranged words or names. The object is to produce an index or directory having means for facilitating the finding of any name which is sought, and which will relieve the mind.

FILE-CABINET.—W. J. Ball, Alamreed, Texas. The purpose of the inventor is to provide an accounting device for use in retail stores and like business places which transact business with a large number of customers each day which may be easily understood and operated, and which will eliminate a large amount of unnecessary book work, while at the same time preserving a correct account of each and every transaction.

Hardware and Tools.

STENCILING AND MARKING POT.—T. F. Addison, New York, N. Y. This pot is for use in holding inks and other substances which can be easily manipulated, which is so constructed that the ink can be easily taken up upon a brush or other device used in stenciling and marking in painting, and for other purposes in which the ink is prevented from settling and which has means for freeing the brush from excess quantities of ink.

FISHERMAN'S NEEDLE.—W. J. May, New Orleans, La. The object here is to produce a needle such as used by fishermen for repairing nets and seines and having a special construction including a knife which can be readily operated when desired. Under normal conditions the edge of the knife does not protrude from the body of the needle so that the blade is held in an inoperative position.

VALVE OR FAUCET.—E. P. McCollom, Baltimore, Md. This device is intended more particularly for embodiments in faucets used in connection with a filter the bottom of which seats on the chambered top of the faucet. The valve in the faucet coacts with a novel arrangement of ports and passages for directing the water from the supply pipe through the filter or merely against the bottom of the filter to wash the same and then directly through the faucet; or the valve may be so turned as to cut off the supply pipe and drain the filter.

STAMP AND LABEL AFFIXER.—G. E. Lacey, Lansing, Mich. The invention pertains to a device to be used in affixing stamps or labels to letters or articles of manufacture. One object of the invention is to provide a device which will automatically grip a label or stamp and dispose it in proper relation on the surface to which it is to be affixed.

DOOR AND DAMPER OPERATOR.—J. Laus, Jr., Oshkosh, Wis. The invention is an improvement in door and damper operators and the object is to provide a spring operated mechanism normally restrained from action for opening and closing, the dampers and doors of a furnace or the like at a predetermined time which mechanism is released by a clock movement.

Heating and Lighting.

WATER HEATER.—J. W. Hardie, Sourlake, Texas. This device is for use for heating feed water in oil or gas burning boiler furnaces. The invention has reference to improvements in feed water heaters and has for its object the provision of an improved apparatus for the rapid and economical heating of water for steam purposes in oil and gas burning boilers.

Household Utilities.

FLY EXIT.—L. W. Clark, Carterville, Mo. The object here is to provide a device of low cost which may be applied to the ordinary window screen with but little cost or trouble and which will permit flies free egress from the room or building, while at the same time effectually preventing their ingress.

PORTABLE FLY CATCHER.—C. H. Pearce and L. F. Tuscher, Aspen, Colo. In this instance the invention relates to improvements in portable means for catching flies. The invention has for its object the provision of a device by the use of which the flies in a house or dwelling may be removed quickly and effectually, while at the same time obviating all of the disadvantages of foregoing methods.

Machines and Mechanical Devices.

MACHINE OR APPARATUS FOR PRINTING, CHECKING AND AUTOMATICALLY SUMMING UP THE VALUES OF TICKETS OF DIFFERENT KINDS AND SERIES.—G. L. F. Boulage, 44 Rue Chanzy, Paris, France. The invention provides a small portable machine for use in printing and checking tickets of different classes and kinds and for automatically adding up corresponding receipts. It effects by a single operation first the impression upon each ticket of the date, destination, price, route and number of days available. Second, the simultaneous impression upon a checking sheet of all data placed on the ticket. Third, the automatic adding up of the sums collected.

STREET-GAGE.—P. Rodoreh, Fond du Lac, Wis. This device detects inequalities in grading of street pavements mechanically adjusts the height of the crown of the paved street, is movably and guidably mounted on the street to be readily shifted over its surface and is capable of being adjusted to varying street widths.

TYPE WRITING MACHINE.—N. F. Pettit, Charleston, S. C. Among the principal objects in view in this case are: To provide a construction to occupy a minimum of space; to provide an arrangement of type wherein a number of characters may be arranged to be employed; and to provide a portable machine which is simple, economical and durable in construction.

COMBINED BALL AND TUBE MILL.—J. E. Kennedy, New York, N. Y. This mill is adapted to comminute ore, cement or the like from a comparatively large size to a fine powder. It is adapted for use in wet or dry crushing and consists primarily in a tube chamber in which crushing is done in two stages. It performs in one machine that which formerly took two to accomplish.

DRILLING-MACHINE.—G. McKnight, Townsend, Mont. This machine affords a positive manually controlled feed for the drill, and facilitates its withdrawal from a bored hole when desired, and also provides reliable means for detachably securing the drilling machine upon an object that is stationary or has sufficient weight to afford proper support to the machine when in use.

STATION INDICATOR.—F. K. Harris, Canandaigua, N. Y. The indicator is intended for use in passenger cars or other vehicles for indicating the next station at which the car or vehicle is to stop. More particularly the invention relates to that type of station indicator in which there is provided a long band or curtain bearing the names of the successive stations and movable to bring successive portions to view.

WIRE FENCE MACHINE.—D. A. Clawson, Waynesville, Ill. This machine is for use in making wire fences in the field and arranged for ready attachment to the line wires of the fence to properly guide or hold the stays while attaching the same to the line wires, and to permit ready attachment of the machine to the line wires to allow the operator to accurately fasten the stays in proper vertical position to the line wires.

KEG RINSER.—A. C. La Budde, Ashland, Wis. The invention consists of a water supply conduit having a nozzle and a controlling valve, a foot lever operable to simultaneously project the nozzle valve into the keg and open the valve, and rollers to support the keg over the nozzle, each roller tapering toward the center to conform to the keg and facilitate its movement to rinsing position.

LUBRICATING ATTACHMENT FOR WINDING MACHINES.—S. Broadwin, New York, N. Y. The invention relates to applying a lubricant to yarn, thread or the like in being wound onto a spool, bobbin or spindle. The object is to apply it to the thread after it is wound on the bobbin or the like, the lubricant preferably being in solid form and held against the sides of the several windings on the bobbin as the latter rotates.

SCALE.—A. P. Johnstone, Cleveland, Ohio. The invention provides a scale having a pouring attachment to deliver only when the receptacle is in receiving position, a pouring attachment adjustable above the scale platform, a locking attachment for the scale beam to prevent the flow from the pouring device except under conditions, a pouring attachment to handle plastic and dry materials with spout openings, and an electrically operated mechanism for terminating the delivery from the pouring device when the desired weight has been obtained.

Railways and Their Accessories.

MAIL BAG CATCHER AND DELIVERER.—G. E. Denison, Vernon, N. Y. This is a device adapted to receive mail or other packages from and deliver mail or other packages to a moving train from a stationary platform. An object is to provide a device which will suspend the mail bag or other package in a locked position until a trigger is tripped by opposing mechanism.

RAILWAY CAR BRAKE.—L. Boirault, 8 Rue Emile Gilbert, Paris, France. The invention consists in making use of the live force of the car to produce the application of the brake in such manner that when the system of operating levers has been brought by hand or through gearing into a determined position a cam operated by a car axle actuates the system of levers and produces the application of the brake blocks to a determined extent and locking them in braking position.

Pertaining to Recreation.

DANCING DOLL.—A. M. Lester, Broxton, Ga. In this instance provision is made for disassembling and packing the separated parts in the stand; for a construction whereby the doll is manipulated to simulate the movements of a dancing person; and for a construction for a doll which is simple, efficient and the wearing parts whereof are rapidly and easily replaced.

Pertaining to Vehicles.

TIRE TREAD.—D. T. O'Sullivan, West Orange, N. J. An object of this invention is to provide a tread having a form which facilitates its attachment to the wheel without producing a puckering of the material at the sides of the tread. Also to provide means for securing the tread to the spokes of the wheel which will prevent slipping and longitudinal slipping of the tread on the tire.

PORTABLE PRISON.—J. B. Kimbell, Cordele, Ga. This invention is applicable to vans for use in transporting convict laborers. Heretofore they have been carried in confined quarters. Considerable inhumanity has resulted from the too close confinement during leisure such as after working hours and on Sundays and holidays in which this class participate. The chief purpose is to overcome the above disadvantages by forming a single detention room or house.

VEHICLE-TIRE.—H. B. Tobias, Hoboken, N. J. The invention comprises the combination of a rim cushions mounted thereupon a composite member having generally an annular form encircling the rim and with portions engaging the cushions, a plurality of members arranged in a general annular form and connected to the composite member, the last members overlapping one another, and a tread supported upon the last mentioned members.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending April 12, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Cars, automatic registering device for street, L. J. Dugan 954,736
Cars, dirt spreading attachment for, E. McCormick 954,530
Cars, safety controlling device for street, E. D. White 954,710
Carbon remover, L. Kastrow 954,491
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Electric vapor apparatus, means for suppressing the resistance of the negative electrode flame in, P. C. Hewitt 954,484
Electric ventilator, W. Mehlhose 955,099
Electric wire terminal, A. R. Mosler 954,873
Electric wires, combined junction and terminal box for, F. C. Woods 954,842
Electrical cut out, P. J. McDonald 954,537
Electrical distribution system, W. A. Turbayne 954,699
Electromagnet, alternating current, L. Larsen 954,745
Engine. See Gas engine.
Engine, F. Mann 954,962
Engine cooling device, gas, J. A. Charter 954,780
Engine starting device, J. W. Tudor 955,017
Engines, air and gas mixer for explosive, G. L. Fogler 954,667
Envelop fastener, S. B. Stimpson 954,479
Envelop opener, O. A. Reed 954,584
Excavator bucket, J. C. Crenshaw 954,926
Excavator, J. S. Henderson 954,966
Excavator, earth, J. F. & S. Kirby 954,921
Exercising apparatus, J. Ertl 954,760

INSECT PESTS IN HOUSE AND STORE.

(Continued from page 344.)

sects. My reason in mentioning it in this place, however, is that it is said to be capable of making a regular tapping noise which is audible to mankind. Its extremely small size, and the softness of its body, make it difficult to understand how this noise can be produced, but I give the fact on the authority of an eminent observer. Before leaving the boring beetles of the genus *Anobium* mention should be made of the species known popularly as the bread or paste beetle (*A. paniceum*). It is very common in houses and possesses a voracious appetite. Moreover, it cannot be termed "dainty," for it appears to eat almost anything which it encounters, from dry wood to Cayenne pepper, although it seems especially to appreciate bread, biscuits or other concoctions in which flour and water are the chief ingredients. It is often most destructive to the stored goods of merchants, as well as to the stocks of grocers and chemists. Two of the photographs here reproduced show samples (1) of marcaroni and (2) ginger riddled by this pest. I have also known it to feast upon dry capsicums. This insect, too, has rendered almost worthless a stock of boots and shoes which, before the advent of the pest, had been valued at many thousands of pounds. This happened in South Africa, although reports of damage have also been received from manufacturers in other parts of the world. Paste had been used in making the boots, to fasten the linings and leather together, and in devouring their favorite dainty—i. e., the paste—the beetles had perforated and damaged the leather so as to reduce it literally to rags.

The so-called paste beetle, moreover, is probably the worst offender among the insect enemies of books. It gets into old libraries, and its grubs gnaw the edges of the pages and drill their tunnels from cover to cover of the volumes. The photograph reproduced here will give some idea of the serious damage of which this pest is capable, and may stand as a warning to all lovers of "first editions" and other costly tomes. In times past many valuable books have been rendered almost worthless in this manner while there is a case on record in which twenty-seven folio volumes, standing side by side, were perforated in a straight line by one *Anobium* grub or "book worm." Its tunnel was so perfectly drilled that it was possible to pass a string from one end of it to the other, and thus lift up the entire set of twenty-seven volumes at once. These grubs have also been known to tunnel through sheet-lead when this has come in their way, a fact which bears witness to the hardness of their heads and the strength of their jaw muscles.

Probably few people, save those who dabble in natural history, are aware that a small moth—one of the *Micro-lepidoptera*—is held in dread by wine merchants and cellarers in many parts of the world. Large numbers of wine cellars are affected by this pest, and its depredations represent an annual loss which must run into many thousands of pounds. Of course, the moth itself is harmful only as the progenitor of hungry caterpillars. But it appears to have renounced the traditional air-and-sun-light habits of moths in general, and to frequent by choice the gloom of subterranean vaults. Here the female insect lays her eggs upon the corks of wine bottles, and when the tiny caterpillars hatch they burrow into the substance of the cork, just as the caterpillar of the big goat moth burrows into the heart of an oak or an apple tree.

The presence of the wine-cork pest is manifested by an accumulation of cork-dust and refuse ("frass") round the exposed portions of the cork. This accumulation may be seen in one of the pictures herewith. Later, if the grubs are numerous, the cork is so tunneled that the wine escapes—this being the so-called "ullage" of wine. Sherry, madeira and champagne corks are attacked indiscriminately; and even when the corks are not so badly tunneled as to produce ullage, the wine usually becomes tainted, and is thus rendered valueless.

Even new corks in store are sometimes injured by the caterpillars of a moth, though in this instance the taste appears to be a recently acquired one, for the insect in question is really the fig moth (*Ephestia ficulella*). As its name implies, its caterpillars feed normally on dried figs. So prevalent is this pest that it may almost be described as a common object of the dessert table, for few figs, save the most recently imported, are quite free from the small white grubs of this moth. In passing, it may be remarked that this insect is also known to attack cocoa beans.

But while the fig moth accomplishes no small amount of damage, its depredations are far less serious and widespread than those of its relative, the codlin moth. This is another of those insects which come unbidden with the dessert. I am able to reproduce a photograph which gives a good idea of the damage done to an apple by this pest. The reader will observe that the caterpillar confines its attack chiefly to the center of the fruit, where it feeds upon the pips and core. Sometimes a most delicious-looking apple, apparently perfectly sound, proves to be full of rottenness on being cut open. It may be that the reader is wondering how the caterpillar got into the apples, just as George IV is said to have wondered how apples got into dumplings. The facts of the case are as follows: The little codlin moth flies about at dusk in orchards just at the season when the young apples are forming. She visits one fruit after another, and lays an egg in the "eye" of each. When the egg hatches, the minute caterpillar burrows into the heart of the apples, making a hole so small that it is unnoticeable when the apple attains its full size. Thus is provided the phenomenon of a hungry grub consuming the interior of an apple which, to all appearances seems to be as inviting as any of its neighbors.

When the grub is full fed it bores its way out of the apple, and eventually spins a cocoon of rough silk in a crevice in the tree trunk, or on a neighboring fence in which it changes to a pupa. Despite its name, the codlin moth does not confine its attention to any particular variety of apple, but attacks all the best kinds indiscriminately. It has attained a very wide geographical range—having followed the apple tree, so to speak, all over the world. It has called forth the maledictions of apple-growers in France, Germany, Great Britain, Canada, Australia and Tasmania, as well as in the United States. In Tasmania it has been so troublesome that the legislature has thought it necessary to pass an act for its suppression.

Tobacco merchants and manufacturers are sorely tried at times by the activities of a beetle known to science as *Lasioderma testaces*. This insect has acquired the habit of feeding upon stored tobacco. It is especially injurious to cigars and cigarettes. Photographs showing examples of its work are reproduced herewith. Yet another beetle attacks nutmegs, coffee berries, and certain kinds of spices. The annexed photograph shows us a sample of Java coffee, some fifteen years old, almost every berry of which has been bored by this pest. Fortunately the attacks of this beetle do not affect the quality of the coffee when ground. Nevertheless, it is quite certain that when buying old coffee one buys also a certain amount of ground-up beetles—and this fact may be displeasing to many. Yet if one were to avoid food or beverages simply because one doubted their freedom from contamination by insects, one would eat and drink very little indeed!

I doubt if there is a man or woman living who has not eaten—of course, quite unwittingly—very many examples

of the weevil known as *Calandra granaria*. This is one of the most injurious pests with which corn merchants have to contend, despite the smallness of its size. I am able to reproduce a magnified photograph showing a few grains taken from a sample of wheat which had been attacked by *Calandra*. The sample fairly represents the condition of a whole cargo of wheat which was rendered practically valueless during a protracted voyage across the Atlantic. In the case of this one shipload, the loss caused by this beetle amounted to many thousands of pounds, while costly litigation ensued. Of course, an instance of this kind is somewhat exceptional. Nevertheless, the corn weevil imposes a constant tax upon stored grain, while it is no exaggeration to state that every granary is infected by this pest. Thus, countless millions of the insects must be ground with the wheat into flour each year, and the weevils must, therefore, form an actual part of the bread which we eat.

Another corn pest is a small moth which is especially injurious to stored flour. Its scientific name is *Ephestia kuhniella*. It is the scourge of the Mediterranean ports, where it is impossible to estimate the extent of the damage which it accomplishes. In November, 1887, *Ephestia* made its appearance in East London—having been brought thither, no doubt, in ships. Its presence was first detected in a warehouse at the docks. Unluckily, over a thousand tons of flour were stored in close proximity; and, although all possible efforts were made to save it, the insects multiplied with such extraordinary rapidity that the trouble taken was of no avail.

Buggy-top Canopies for Launches.

Experiments have just been completed by the naval constructors with a view to the adoption of a new type of canopy for use on the naval launches.

When the launch of the U. S. S. "Minnesota" was lost in Hampton Roads with several midshipmen on board about a year ago, the fatality was attributed to the fact that the canvas covering used as a protection against the weather was fastened in such a manner that it could not be quickly released, and the men were hopelessly imprisoned in the sinking boat. This fact led to much criticism of the type of canopy used and the steam launches came to be known as "death traps."

The constructors have been working on a design intended to overcome that difficulty, and several types of canopies were tested on launches of the Atlantic fleet within the last two or three months.

The result of these tests is the adoption of what is commonly known as the buggy-top canopy. This is made of canvas, and is attached to rods in such a manner that the canopy can be easily adjusted and folded out of the way, similar to those used on automobiles.

While the new style of canopy will not be as durable as the old fashioned one, and will not afford the same protection against wind and rain, in case of a collision, and the launch is in danger of being sunk, it can be quickly put out of the way and not endanger the lives of the occupants of the boat.

By microphotographic methods, the vibrations in an incandescent filament, due to the expansion and contraction caused by the passage of an alternate current, have been recorded. An arc lamp was used as the source of light for photographic purposes, and if the arc is fed from the same alternator as the incandescent filament, the vibrations are seen from the plate to synchronize with the rise and fall of the alternating pressure. With a 100-candle-power osram lamp, supplied with alternate current at 50 alternations, a slight humming noise was perceptible even at a distance of three yards. The experimenter considers that this may be a cause contributing to the shorter life of a metallic filament on alternate current.

Exploder, delayed action electric, R. L. Oliver 954,880
Extension table, C. K. Hough 954,716
Fabric sponging and finishing machine, A. J. Hamma 954,861
Fabrics, tool for patterning piled, M. Urbartsch 954,482
Fastening device, F. H. Richards 954,783
Faucet, W. B. M. Bashlin 954,807
Faucet, T. G. Kus 954,744
Feed hoppers, cut off device for, G. P. & P. D. Burke 954,870
Feed receptacle, C. I. Flanagan 954,848
Feeder, horse, J. C. Snyder 954,906
Filter, H. Pond 954,647
Fire hose carrier, H. I. Jenkins 954,807
Firearm, M. F. Smith 954,604
Firearm, A. H. Stockwell 954,601
Firearm, C. A. Young 954,603
Firearm, J. C. White 954,904
Firearm, automatic repeating, O. H. J. King 954,441
Firearms, breech closing mechanism for automatic, C. I. Ross 954,543
Fish hook, M. B. Eckhardt 954,768
Floor scraper, J. F. Weber 954,486
Flower pot, H. Klemm 954,440
Fluid compressor, Annable & Fitz Gerald 954,600
Fluid indicator, E. A. Cramer 954,432
Fly paper, sticky, C. J. Rum 954,887
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Flying machines, means for steering, King & Steiner, Jr. 954,874
Folding machine, D. H. Brown 954,771
Food hopper, J. A. Jory 954,968
Frame. See Bed frame.
Furnace heating and ventilating fresh air injector, F. O. Nelson 954,869
Fuse cap, miners, C. F. Story 954,595
Fuse holder for single pole circuits, mullen, H. Wheeler 954,838
Gallnvanins and making same, derivative of, C. Bartiont 954,040
Game apparatus, F. H. Heath 954,0,7 954,828
Game apparatus, bowling, R. F. Downey 954,943
Garbage evaporator and cremator, I. L. Dearie 954,878
Garment, A. I. Dautrey 954,065
Garment hanger support, G. M. Blanford 954,830
Gas and electric fixture combined, A. I. Schwinger 954,009
Gas engine, W. I. Morrow 954,577
Gas safety device, R. H. Cowdrey 954,783
Gas separator, W. M. Arthur 954,484
Gases, apparatus for treating burner, J. R. F. Hirsch, Jr. 954,067
Gear and brake mechanism, variable, J. Archer 954,664
Gear, variable speed, J. Archer 954,665
Gearing, differential, King & Lockwill 954,744
Gearing for metal working machines, Innes & Gilson 954,659
Gearing, multiple speed driving, N. A. Dillerjohn 954,072
Gearing, speed, I. Morgan 954,047
Gearing, transmission, A. I. Moore 954,[illegible]
Glass forming machine, C. W. Brown 954,[illegible]
Glass making machine, P. Hines 954,086
Glass, method of and apparatus for making wire, P. T. Sr. & F. Cyvaux 954,078
Glass, mode and means for manufacture of sheet, F. M. Oppermann 954,457
Gold washer, dry, G. W. Palmer 954,780
Gopher trap, A. F. Renken 954,996
Governing mechanism, M. M. Cameron 954,046
Gravity engine, I. F. Hunt 954,073
Grading machine, road, C. W. Horton 954,071
Grading machine, road, P. J. Jewett, reissue 13,101
Grain stripping machines, adjustable comb for, K. A. A. Lacy 954,088
Grass cutter, C. E. Hann 954,109
Grate bar, J. R. Wilson 954,011
Grinding machine, Ivy D. Trillman 954,540
Gum breaking machine, H. Y. Armstrong 954,773
Gun, automatic, G. Hammond 954,[illegible]
Gun lock, M. Taylor 954,015
Gun recoil loading, C. A. T. Sjogren 954,546
Hammock, baby, W. H. Conners 954,[illegible]
Hand strap, M. I. Douglass 954,[illegible]
Handle. See Swab handle.
Harness hames, J. Compton 954,490
Harrow, J. R. Navler 954,789
Harvester, F. Tesch 954,418
Hasp or catch, spring, J. R. Iddle 954,777
Hat hanger, H. A. Scott 954,974
Hat holder, G. A. Schubert 954,474
Hat matrix, I. Stevens 954,676
Hat pin, safety, B. Brownstein 954,776
Hat pressing machine, H. C. Baron 954,405
Hat shield, J. H. Townsend 954,706
Hauling and hoisting apparatus, H. T. Phillips 954,881
Hay handling mechanism, M. H. Malone 954,804
Hay rake, C. F. White 954,902
Head rest bar, T. J. McNeil 954,004
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Heating system, H. C. Mallory 954,887
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Heel, boot and shoe, M. I. [illegible] 954,100
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Hook and eye, C. B. Patterson 954,448
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Hub, vehicle, J. A. Fillman 954,680
Hydraulic installation, Levitt & Betten 954,[illegible]
Ice cream dish, H. Binder 954,[illegible]
Ice manufacturing apparatus, J. F. Rogers 954,467
Index system, F. A. Bagby 954,604
Indicator. See High water indicator.
Induction furnace, K. A. F. Hiorth 954,804
Innersole, G. F. Rollins 954,104
Insect destroying lamp, D. M. Rogers 954,591
Insulating device, J. Stevens 954,767
Insulator, A. T. Stalkermann 954,606
Insulator, C. C. Harlin 954,005
Insulators, machine for threading porcelain, G. F. Young 954,590
Integrating device, H. I. Merrick 954,050
Integrating device, H. I. Merrick 954,070
Iron, vulcanizing, W. I. Dissmeyer 954,[illegible]
Ironing board, W. I. Cash 954,062
Ironing board, adjustable, J. G. Kirkpatrick 954,062
Ironing table, C. H. Tillis 954,087
Jack and centering trip, combined, I. J. Grubler 954,624
Joint. See Lamp joint.
Joint clamp, Cable & Bailey 954,608
Key fastener and key ring, combined, J. W. Clark 954,920
Kiln, M. Ittner 954,633
Knapsack and the like, A. Schumacher 954,805
Knife. See Asparagus knife.
Knitting machines, automatic cleaner for, latch, E. C. Cook 954,052
Label folder mechanism, F. O. Woodland 954,841
Labeling machine, bottle, A. N. Ketterer 954,615
Ladder round support, W. J. La Fleur 954,811
Lamp, J. A. Cameron 954,779
Lamp, electric, R. M. Newbold 954,474
Lamp, kerosene, B. J. R. Ihig 954,[illegible]
Lamp socket, J. G. Bartlett, H. R. Barnett 954,[illegible]
Lamp sockets, adjustable casing for electric, C. D. Hiatt 954,[illegible]
Lamp, trick electric pocket, A. Tell 954,078
Lamps and sockets, lock guard for incandescent, H. Hubbell 954,[illegible]
Lamps, sign attachment for, F. J. Pfister 954,[illegible]
Land packer, A. F. Smith 954,[illegible]
Last, lift, M. R. Kester 954,[illegible]
Lard cutter, J. D. Leon 954,411
Lathe, last, M. H. Lyons 954,447
Lathe, multiple turning, A. B. Norris 954,450
Lavatory, T. M. Kenney 954,080
Lawn edger, gaged, J. C. Lindsey 954,747
Lawn edging machine, W. E. Graham 954,[illegible]
Leather trimming machine, B. Grossman 954,[illegible]
Ledger locking device, T. A. Glendinning 954,781
Lens, H. P. Alexander 954,773
Lens mounting, D. F. Green 954,711
Lever, operating, W. C. A. Henry 954,415
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Liquid heating and applying apparatus, O. H. Ebrecht 954,047
Liquid separator, centrifugal, C. D. Hellstrom 954,958
Loading and unloading apparatus, A. R. Holmen 954,572
Loading device, G. V. Hughes 954,683
Loading machine, portable, W. O. Zelle 954,494
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Lock, W. F. Diesel 954,750
Locomotive, electric, F. L. Sessions 954,679

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Inquiry No. 9076.—Wanted the address of parties in Canada who could make a safety razor.

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Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

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Inquiry No. 9095.—Wanted, name and address of the manufacturer of the duplex revolving pencil sharpener.

Inquiry No. 9096.—Wanted, the address of manufacturers of spiral welded pipes, possessing great strength.

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Inquiry No. 9098.—Wanted, name and address of the manufacturers of the ozonizer.

Inquiry No. 9099.—Wanted address of manufacturers of machinery for making wire cables.

Inquiry No. 9101.—Wanted addresses of manufacturers of a dip or magnetic needle, for exploring for iron ore.

Inquiry No. 9104.—Wanted addresses of manufacturers under the name of A. O. Co. Standard.

Inquiry No. 9106.—Wanted addresses of cotton dealers who can furnish cotton material for manufacturing envelopes.

Inquiry No. 9107.—Wanted addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Ilion Desk Clock.

Inquiry No. 9110.—Wanted to buy machinery for reducing old tin cans, so that they may become a source of revenue.

Inquiry No. 9112. Wanted sample small dry vacuum pump about 6-inch diameter cylinder inside, high temperature metal packing.

Inquiry No. 9113.—Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114.—Wanted name and address of manufacturer of the Auto Lantern Globe. Fits all lanterns.

Inquiry No. 9115.—Wanted a machine for making pen nibs, similar to Wm. Mitchell's G. & J. nibs and Waverly nibs.

Inquiry No. 9117.—Wanted names and addresses of the manufacturers of pedometers.

Inquiry No. 9118.—Wanted, a muffler for a gasoline engine, built upon the principle of the Maxim silencer, recently brought out for use on rifles.

Inquiry No. 9119. Wanted, name and address of the manufacturer of Kaslin bullet-proof cloth.

Inquiry No. 9120.—Wanted the address of the Ideal Fuel Feeder Co.

Inquiry No. 9121.—Wanted manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9124. Wanted name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9127.—Wanted, address of L. Dermigny, manufacturer of a family ice machine for $10.00.

Inquiry No. 9131.—Wanted information as to how or where I could get a sample of tin ore.

Inquiry No. 9132.—Wanted, manufacturers of a gasoline traction engine with a hoisting attachment; in other words, the machine will be used as a portable stump puller to pull sassafras roots, used in making oil of sassafras.

Inquiry No. 9133.—Wanted manufacturers of floss candy machines.

Inquiry No. 9134.—Wanted, a small hydraulic motor capable of giving about one horse power with a water power of 35 lbs. per square inch.

Inquiry No. 9135.—Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted the address of manufacturers of machines capable of forming a number (12 or more) of pieces of paste about 35 mm. x 52 mm. x 6 mm. made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 4 mm. The process could be somewhat similar to biscuit making.

Inquiry No. 9139. Wanted, the name and address of some manufacturer of a coffee mill run by water motor.

Inquiry No. 9140.—Wanted, manufacturers of disc records for gramaphones that use a sapphire point instead of a steel needle.

Inquiry No. 9141.—Wanted a boat like a rowboat, worked by levers in place of oars which by a series of pulleys attached operates a propeller; the steering device is managed with the feet.

Inquiry No. 9142.—Wanted, an appliance used in ice chests to make ice last longer.

Locomotives, exhaust controlling device for, J A Richardson	954,968
Loom, G A Mcmullan	954,450
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Loom stop motion, H W Williams	955,090
Lubricator, C J Van Doren	954,600
Lunch box, A Biro	954,918
Mail carrier, J W White	954,554
Mail crane, C F Morris	954,988
Mail receiving and delivering apparatus, F Gardner	954,952
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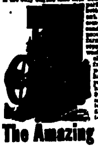

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[illegible]	[illegible]

LABOR SAVING DEVICES FOR OFFICE WORK—Labor Saving Devices will be exhibited at the Treasury Department, Washington, D C, during the week beginning May 2, 1910. Requests for information and applications for entry stating the amount of space desired at this exhibit should be filed with the Secretary of the Treasury on or before April 20, 1910. Exhibits must be in place not later than 4:30 p. m Friday April 29, 1910. Electric current (110 or 220 volts direct) will be furnished.

WANTED.—Two third class sub inspectors (electrical) at $4.00 per diem. A competitive examination will be held April 25, 1910, for the purpose of filling the above positions. For further information address, "Commandant, Navy Yard, Brooklyn N Y

RUBBER STAMP MAKING—THIS article describes a simple method of making rubber stamps with inexpensive apparatus. A thoroughly practical article written by an amateur who has had experience in rubber stamp making. One illustration Contained in SUPPLEMENT 1110. Price 10 cents. For sale by Munn & Co. Inc. and all newsdealers.

Steering attachment safety H P Laronette 954 979
Stencil machine, C L Burdick 954,926
Stoker, mechanical J A Caldwell 954,717
Stool motorman's, W E Fawcett 954 837
Stopper tie W S Dow 954 363
Store front construction F J Plym 955 103
Store service track E J Brault 954 611
Stove and stand, vapor Savage & Guttermann 954 708
Stove gas, A C Wilman 954,357
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Stud collar P Eppelsin 954 705
Studding metal H E White 955 111
Superheater J E Bell 954 913
Superheater boiler J E Bell 954 914
Supply and overflow fixture combination W S Graham 954 731
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Talking machine attachment W S Mc Namara 954 455
Talking machine sound box, R L Gibson 954 963
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Thermometer dial C H Myers 955 091
Thread holder bobbin R. G Cone 954 962
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A printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co Inc 361 Broadway New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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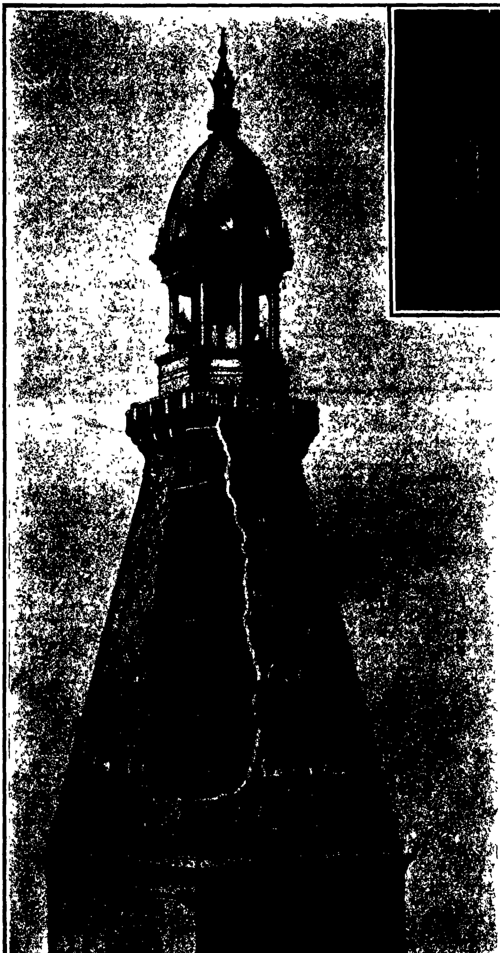

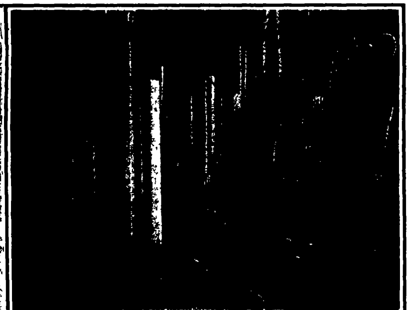

The upper ends of the elevator shafts. Motors installed at top of tower. Position of elevators in shafts.

HOW THE PROBLEM OF INSTALLING THE ELEVATORS OF THE METROPOLITAN TOWER WAS SOLVED.—[See page 358.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

WHY NOT A GOOD ROADS LABORATORY?

THE problem of maintaining good roads, always a most important one in the United States, has recently been rendered of critical urgency by the rapid development of the automobile—the most destructive vehicle to road surface that ever ran on our modern highways. The public resentment or regret, as the case may be, against the destructive effects of automobile traffic should be tempered by the recognition of the fact that it has been the most active instrument in awakening the public to the necessity for abandoning the old slipshod methods of road building, and constructing them according to the best engineering practice.

If it were possible to rebuild all our roads of the most approved and highest class of construction, and if the most suitable material were everywhere available, the problem would be greatly simplified, but such uniform excellence is impossible, both because of the cost and of the difficulty of finding the ideal materials within economical hauling distance of the work. In a country of such wide extent and such varied geological formation as the United States, the question of the best kind of roads to build in any locality must be determined largely by the local conditions—the climate, particularly as regards the amount and distribution of the rainfall, the nature of the underlying soil, its bearing quality, capacity for quick drainage, etc., and above all, the character of the materials available for road building, must all enter into the problem.

The French engineers, with their characteristic thoroughness, have long recognized the importance and complexity of the good roads problem, and nearly half a century ago they commenced that careful investigation which is still being carried on by a force of trained experts. The analytical study of the subject, which was set on foot by M. Ruffet, Engineer of Roads and Bridges, as far back as 1868, has developed into the present municipal laboratory, which has so greatly extended its field of work that to-day it is considered by many to be the finest in existence. At the date mentioned, apparatus was installed for testing the resistance of paving materials to wear by friction, which was followed by a machine for testing the resistance to abrasion of the stone used in Macadam roads. The laboratory also includes means for artificially producing those conditions and forces of a climatic character which tend to break up and destroy road surfaces.

Now here, it seems to us, is a plan which might very well be followed in this country by the founding of a national good roads laboratory, say at Washington, which might co-operate with similar but smaller institutions provided for and controlled by the various State legislatures. The cost of carrying on such institutions would represent but a moderate percentage of the money that is annually thrown away on the construction and so-called repair of highways by the present defective methods.

RATIONAL STREET LIGHTING

THE proper lighting of a city is not so much a question of the total quantity of light provided as it is of its proper distribution. Because of the fact that America is the birthplace of modern electrical illumination, and the country in which it was first developed on an extensive scale, there is a popular impression that our municipal lighting is the best in the world, yet it is a truth that, because of the unscientific way in which we have distributed our lighting, the resultant illumination, judged by its adaptability to the needs of the user, is far less satisfactory than it might be, and, in its general results, is not as efficient as the lighting of European cities. This question was recently dealt with by Dr. Louis Bell in a paper read before the American Society of Municipal Improvements at its annual convention, and the principles which he laid down are at once so obviously sound and so frequently disregarded, that they are well worthy of careful study by the municipal authorities throughout the country.

The fundamental criticism against most attempts at street lighting lies, according to the author of the paper, not so much in the illuminants used as in their improper adjustment to the needs of the city. The fault particularly noticeable in American cities is the lack of careful discrimination between streets which demand considerable light and those which are perfectly illuminated with a less quantity of light. Most schemes of lighting aim at an approximation to uniformity of illumination over the whole area of the city, whereas, its quantity and character should rather be determined by the particular character of the streets in which it is placed. The main thoroughfares, in which there is considerable night traffic, should receive an amount of lighting commensurate with their importance, but in streets where traffic is light, and where passers-by are few, it is sufficient to provide enough light to enable the people to get about comfortably. So also, a third class of streets, lying more remote and coming under the head of suburban roads, require yet another method of illumination. Since the fundamental purpose of lamps in the outlying, little-used streets, is to serve as markers of the way, the using of very large units, widely spaced, is obviously improper, a better way would be to employ small units located at shorter intervals.

The principal streets of American cities, according to Dr. Bell, as a rule are poorly lighted, the secondary streets are lighted sometimes better and sometimes worse than they should be, and the third class usually have one lamp in every long block, which is useless, except within a comparatively short radius, for such purposes as finding the number of a house or reading the address in a note book. As to the absolute amount of light required, the principle should be followed that in the principal streets one should everywhere have enough light to read a paper by, which is the standard of illumination adopted in the principal streets of the large cities of England and continental Europe.

Much of the faulty street lighting in the United States is chargeable to the method commonly employed for measuring street illumination. The usual plan is to measure the light half way between the lamps with the photometer disk held normal to the ray, and, naturally, the tendency of competitors for the lighting contracts is to secure the specified minimum at as low a maximum as possible. Indeed, certain types of illuminants have been deliberately specialized for the purpose of giving two-hundredths or three-hundredths of a foot-candle at a distant point. Now, if these illuminants had been designed as they should have been, not to give a special form of illumination, but to give the best efficiency of which they were capable, it would be possible to make them light not only widely distant parts of the street, but the whole street. While it is not desirable to attain to uniformity with a low average of light, it is equally undesirable to concentrate the light at certain points separated by long stretches of comparative darkness. Summing up, the important points to bear in mind are, first, that streets are lighted for the people to use, second, that the streets should be lighted with reference to the particular use which is going to be made of them, and third, that, speaking generally, all the streets should be more brilliantly lighted than is customary in the United States to-day.

A BATTLESHIP FLEET IN EACH OCEAN.

FOR many years our Navy Department has followed the policy of concentrating an unusually large percentage of the total displacement of our ships in battleships of the first class. Every nation is following the same policy to-day, and has done so since the introduction of the first dreadnought in 1906. Many years before that date, however, the United States had practically ceased to build protected cruisers, and was concentrating its strength in vessels of the armored class, the majority of which were heavily-gunned battleships.

The advantage of this policy is seen in the fact that in a year or two's time it will be possible to maintain two complete battleship fleets, each of four divisions of four ships, one in the Atlantic and the other in the Pacific. Each of these fleets would possess a certain number of dreadnoughts, and would, therefore, be individually much more powerful than the one which made the recent cruise around the world. Although the department does not contemplate making such a division of our battleship strength at that time, it is [illegible] the steady growth of our navy has [illegible] position to take [illegible] deemed advisable to do so.

The plan which is now under consideration is to make, within the near future, a complete reorganization of the Atlantic fleet. The details of the reorganization, which is evidently official, are published in the current issue of the Army and Navy Journal. It is proposed to place five ships in each division instead of four, so that all the ships may dock at their home yards twice a year, and one ship may be in her yard for repairs at any time, without taking from the usual strength of the division. The four divisions will be assigned to the yards at New York, Norfolk, Philadelphia and Boston, one division to each yard—a disposition which will enable the division commander to have his force at all times under his eye and immediately within reach. Practically no ship will be out of commission or in reserve, and when the vessels are in the yard for overhauling, they will have as nearly a full complement of men as possible, no battleship crew being allowed to go below 350 men—a force which would be sufficient to maintain the ship in condition to go into service at twenty-four hours' notice. The first division will dock at the New York yard, the second at Norfolk, the third at Boston, the fourth at Philadelphia, and the armored cruiser division at the Portsmouth yard.

If the present plans are followed the battleship fleet in the year 1911 will be made up as follows: First Division, flagship "Connecticut," and the five dreadnoughts "Florida," "Utah," "Delaware," "North Dakota," and "Michigan." Second Division, the dreadnought "South Carolina," and the sister ships "Louisiana," "Kansas," "Vermont," and "New Hampshire" of the "Connecticut" class. Third Division, the four sister ships "Georgia," "Nebraska," "New Jersey," and "Virginia," of the "Georgia" class, and the "Ohio." Fourth Division, the "Minnesota" of the "Connecticut" class, the sister ships "Mississippi" and "Idaho" (smaller "Connecticuts"), and the sister ships "Maine" and "Missouri." There will be a fifth division consisting of the four armored cruisers "Tennessee," "Washington," "North Carolina," and "Montana." In the year 1912 we shall have sufficient battleships to provide for a fleet in active service, consisting of twenty-one battleships and a Reserve Fleet of eleven of the older battleships. The first division of the active fleet will consist of six dreadnoughts, the second division, of two dreadnoughts and three "Connecticuts", the third division, of three "Connecticuts" and the two smaller "Connecticuts," "Idaho" and "Mississippi," and the fourth division, of the five vessels of the "Georgia" class. The fifth division (armored cruisers) would consist of the four ships of the "Tennessee" and "North Carolina" class.

Our readers will recognize at once that in the above organization, ships of the same general type have been assembled in the same division. The largest vessels will dock at the New York and Norfolk yards, where the largest drydocks and the best facilities are to be found. The commander-in-chief and the auxiliary vessels of the fleet will make their home at the New York yard since that is the most central point for the purpose. The reserve fleet will be kept at Philadelphia, and the most effective destroyers and torpedo boats will be maintained in commission at New York, Boston, and Norfolk.

By the year 1912, then, the United States navy will contain thirty-one battleships, made up of four divisions, with four ships in each division always ready for sea service and one at the yards for overhauling and refitting, and each division commander will have all the ships of his division within immediate reach throughout the whole of the year. At the same time, should the political situation be such as to render this desirable, as we have noted above, it will be possible to divide this force into two fleets, one for each ocean, each fleet being of considerably greater fighting strength than the one that made the memorable cruise around the world.

W. R. Ham finds by direct observation on the primary Roentgen rays that a polarization exists and is independent of the position of the normal to the target. The max. intensity is, within experimental error, in the plane through the target normal to the kathode-ray stream, and the intensity falls off symmetrically on either side of this plane. The interposition of sheets of silver and tin causes an increase in polarization which reaches the same upper limit for both metals. Lead decreases the polarization, but no lower limit was observed. Aluminium, [illegible] and glass cause very slight changes, if any, in the polarization. All the observed results are [illegible] explained if it be assumed that the primary [illegible] ray beam consists of a mixture of primary and secondary rays originating in the target, and that the secondary rays are [illegible].

ENGINEERING.

The fine old cup defender, "Volunteer," which was bought by Capt. Bart last year, has been sold to a firm of wreckers, who will break her up for the value of the lead and fittings. She was the craft that proved so thoroughly the master of the Watson cutter "Thistle" in 1887. "Thistle," by the way, under her present name of "Comet," is still in good shape, and is still being used, we believe, as a training ship in the German navy

The three engineers appointed by the Canadian government to consider the application of the St. Lawrence Power Company for permission to dam the Long Sault Rapids at Cornwall, Ontario, report that the enterprise is worthy of most serious consideration. They urge that, before the government approval is given, there should be a complete agreement between Canada and the United States as to the supervision and control of plants on both the Canadian and New York State banks of the river.

It is officially stated that all the excavation that was contemplated in the original project of the Panama Canal has now been completed The original plans of the canal called for the removal of 103,795,000 cubic yards of material, and a few weeks ago the total excavation done to date under American occupancy had reached that amount. The 71,000,000 cubic yards remaining to be excavated represent the additional work necessitated by the enlargement of the canal, which was decided upon during the Roosevelt administration

The Canadian government is giving consideration to a project for a freight traffic railway to Hudson Bay, surveys for which are now being made. An unusual feature is that the new road would have to be operated to its full capacity for about two months of the year, during the moving of the grain crop, and that for the other ten months there would be scarcely sufficient traffic to warrant operation It is estimated that sixteen trains per day could be handled over the single-track line, and sixty-four million bushels of wheat could be delivered in thirty days' time

The battleship "Indiana" has undergone some tests of the "ship brake" with which she has been equipped This device consists of a pair of steel wings, hinged to the vessel's side and normally held against the ship, which, when a quick stop is to be made, as in the case of impending collision, are released through mechanism controlled from the bridge. They swing open automatically through the forward motion of the ship, and it was found that the vessel could be brought to a stop within the distance of her own length without injurious shock or strain

The "Neptune," the latest of the British dreadnoughts, will have, it is stated, the same length over all, 560 feet, as our own "Wyoming," but her beam will be several feet less than that of the American vessel. She will carry ten 50-caliber 12-inch guns in five turrets, the two turrets amidship being placed diagonally, so as to enable all ten guns to be fired on either broadside Her concentration of fire from her 12-inch guns will be six ahead, eight astern, and ten on the broadside, as compared with the "Wyoming's" fire of four ahead, four astern, and twelve on the broadside

The United States Steel Corporation, which recently made a general increase in wages, has decided to put in force a system of pensions and disability payments for the wives and children of those killed in its employ, and of disability payments for the injured The corporation will also shortly put in force a pension system for superannuated and disabled employes. This movement is to be most highly commended In its humanitarian aspect, it will be a great boon to the employes, and its wisdom as a means of promoting loyalty and checking the growth of anarchistic sentiment is unquestioned.

Construction work will shortly commence on another of those stupendous buildings which are rapidly earning for New York the right to be called a city of towers. The new structure, which is to be built at the northwest corner of Wall and Nassau Streets, on a ground plan measuring 94 by 97 feet, will extend 539 feet above the street level, an elevation which will make it the third tallest office building in the world, the Metropolitan tower being 700 feet high, and the Singer tower 612 feet. The tower will be finished with a pyramidal cap 94 feet in height, which will be utilized for holding the water tanks.

The Great Central Railway of England recently performed the feat of transporting a 77-ton casting upon a 50-ton car. This was done by coupling a flat car on each end of the carrying car, and mounting upon each of the flat cars a massive, trussed, oak girder. The inner ends of these girders extended above the ends of the 50-ton loaded car, to which they were attached by chains. The girders were pivoted at the center of the two flat cars, and their outer ends were loaded with about 34½ tons of dead weight. This arrangement served to transfer 15 tons of the load from the carrying car to the flat cars, thus bringing the actual load [illegible]

ELECTRICITY.

At a recent meeting of the Electrical Club of Chicago, it was brought out that there are three thousand storage battery automobiles in Chicago. There are thirty-three storage battery installations in the city with an output of 47,000 kilowatts, while in New York city the total output is 57,000 kilowatts.

An old barge has been equipped with electric welding apparatus at Gothenburg, Sweden, to be used in repairing the boilers of steamers. The equipment consists of a De Laval turbine and two direct-current generators. The current is conducted to the steamer requiring repairs by means of a pair of cables, and work can thus be done within the boilers with power generated on the barge. The barge is also fitted with a workshop where small repairs may be made.

An enterprising newspaper in South America is about to install a wireless telegraph system at its main office. This will be the first wireless newspaper office on the continent. The paper we refer to is La Prensa, of Buenos Ayres. The Argentine Republic is going to celebrate its hundredth anniversary with an exposition this year, which opens on May 25th, and La Prensa expects to keep in "wireless" touch with the exposition grounds.

A French inventor, M Paul Jegou, has devised an electrolytic detector which operates without the use of a battery to affect telephone receivers. The detector consists of a glass cup containing at the bottom a small amount of mercury with some pure tin in solution This serves as one electrode, while the other electrode is of the usual type, namely, a fine Wollaston wire. Dilute sulphuric acid is used for the electrolyte The detector is found to act like a small battery, and yet possesses all of the sensitiveness of the electrolytic detector One of these detectors used at Paris was found to receive signals sent from the Ouessant post on the coast.

Considerable attention has been directed of late to the effect of sunlight on the transmission of Hertzian waves. A writer in Elektrotechnische Zeitschrift, in commenting on this subject, points out that the stronger the sunshine the less the conductivity of ether to the Hertzian waves, so that it is incorrect to speak of a wireless telegraph station as having any definite range, for one which has a large radius of communication in northern latitudes would have a much smaller radius in the tropics This would be particularly noticeable on vessels sailing north and south, and he suggests that it would be desirable to prepare a "radio-topographical" map, giving the relative conductivity of the ether at different latitudes

A comparison of the inclosed arc and the intensified arc for indoor lighting was recently presented before the Minnesota Electrical Association convention It was shown that because of the large carbons used in the inclosed arc, the carbons being half an inch in diameter, the arc is apt to wander along the edge of the electrode, so that instead of giving a uniform distribution of light, the light is greater on one side of the lamp than on the other With the intensified arc lamp, there is no wandering of the arc. The electrodes are much smaller, consisting of two upper electrodes a quarter of an inch in diameter, and a lower one three-eighths of an inch in diameter If the same amount of current is passed through this lamp as through the inclosed arc lamp, the electrodes will be heated to a higher incandescence, thus giving a greater and steadier light.

The Board of Underwriters of Chicago has issued the following requirements for wireless telegraph installations Aerial conductor must be at least No. 8 B and S. gage rubber-covered wire run on petticoat insulators on exterior of building and on knobs, cleats or in molding in interior of building. Porcelain bushings to be used through walls, partitions and floors. Aerial conductor must be permanently and effectively grounded at all times when station is not in operation by a conductor not smaller than No. 4 B. and S. gage rubber-covered copper wire run as nearly in a straight line as possible to a water pipe at a point on the street side of all connections of said water pipe within the premises, or to some other equally satisfactory artificial earth connection, such as an iron rod or pipe driven at least 5 feet into the earth. Ground wire should be protected from mechanical injury by inclosing it in molding at least 7 feet from the ground on exterior of building. The switch employed to join the aerial to the ground connection must be an approved 100-amp, single-pole, double-throw knife switch placed as nearly as possible to where aerial enters and must effectively cut off all apparatus within the building. Aerial conductor may be permanently connected at all times to earth through an approved lightning arrester placed as nearly as possible to the point where the wire enters the building and grounded as specified above. Ground wires for lightning arresters must not be attached to gas or steam pipes within the building, nor be run inside of iron pipes.

SCIENCE.

In a recent number of the Astronom Nachr., C. Ceraski calls attention to a new variable star or nova, found on a plate taken March 23rd, 1909, at 10h 6m. to 12h. 6m (Moscow mean time) The image was found in a position that was vacant on 24 previous plates, showing stars down to 12.5 magnitude. The star's approximate position is α = 8h 29m 26s, δ = + 53 deg 50 min (1900)

G. A. Campbell recently conducted some experiments to investigate the subject of telephone intelligibility In his experiments, usually only detached syllables were employed, so as to give the listener no clue from the context. The syllables easy to interchange are right in about half the cases Thus while it is obvious that the telephone seriously distorts speech waves, nevertheless, even those consonants which nearly resemble each other are not sufficiently distorted to be indistinguishable

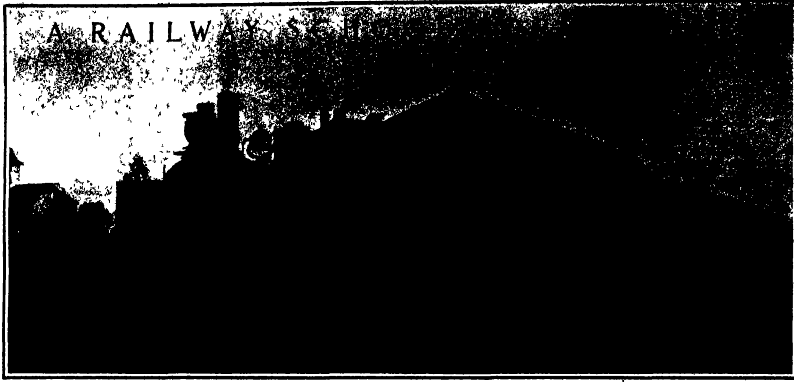
A good photometric measurement of the brightness of the nucleus of Halley's comet was obtained on April 21st by Prof Wendell at the Harvard College Observatory The measured magnitude of the nucleus was 6 4 The total brightness of both the nucleus and the surrounding coma was a little above the fifth magnitude. With the approach of the moon toward the region in the sky in which the comet is found there will be very little to repay the early riser In fact, astronomers do not look for any spectacular display while the comet is in the eastern sky

From a study of the radio-activity at the earth's surface, made by G A Cline, it would seem that the soil contributes by far the greater proportion of the penetrating radiation present at the earth's surface at Toronto, and by comparison any that may have its source in the atmosphere or in the sun may be considered to be negligible in amount There are no regular diurnal maxima or minima, but there are changes from day to day which seem connected with concurrent barometric changes The conductivity is greater when the ground is bare and warm than when it is frozen and covered with snow Filtering air through cotton-wool still leaves many suspension particles

A letter has been received from Prof E B Frost, director of the Yerkes Observatory, at Harvard College Observatory, in which Prof Frost records recent observations of Halley's comet. He found the comet more conspicuous than the adjacent star Praesium, and Prof Barnard estimated the nucleus which was not stellar, to be two magnitudes fainter than this star On April 14th the comet was photographed with six minutes exposure No tail was visible with any of the instruments Visual observations of the spectrum were made by Prof Frost and Dr Slocum, and showed a distinct continuous spectrum from the nucleus No bright bands or lines were seen The intensity of the continuous spectrum relative to the emission bands, has greatly changed since the comet was visible in the evening

Some idea of the enormous amount of labor required to extract radio-active substances from their ores may be gained when it is considered that to obtain two milligrammes of substance containing 0 1 milligramme of polonium, it was necessary for Madame Curie and A Debierne to treat several tons of uranium Fairly pure helium was isolated from the gases given off by a solution of polonium under a high vacuum in a quartz tube, due to the action of the alpha rays emitted by this element. The life of radium is about 5,300 times that of polonium (which is reduced to one-half in 140 days) The spectrum is being studied with a view to ascertaining if an inactive element is derived from it, polonium according to theory, being the last radio-active term in the series of derivatives from radium The atomic weight was estimated to be about 200

A new preparation has appeared which cleans and polishes silver, silver plate, nickel and other white metals, and which is said to produce a plating on pure silver and any metal except gold by mere contact of the preparation with the metal In view of the publicity given lately in British scientific journals to a similar preparation invented by Rosenberger it is interesting to note that the American article has been known in the United States for several years although offered more prominently only since 1908 Rosenberger's preparation requires a different modification for each metal The American preparation is a white, creamy liquid, perfectly stable and unaffected by light, and is claimed to be perfectly free from mercury, acids and other injurious ingredients. So far as we are able to determine, its plating action seems to be due to the affinity which the metal to be plated exerts upon the molecules of silver in the solution, so that the resultant plating is identical with that produced by ordinary dynamic electroplating No electric current is necessary to produce the plating nor is an addition or admixture of any other substance required.



Demonstration train at a way station in California.

In response to an urgent request from leading dairy interests in Southern California, Prof Leroy Anderson, head of the dairy department of the California College of Agriculture, has just made an examination of the milk conditions in that part of the State.

Prof Anderson says that in consultation with the dairymen, it was decided to inaugurate a general policy of education upon the subject In his opinion, the reform of many conditions now undesirable in the methods of producing milk, can better be reached through the commercial aspect of the business and through the education of the producer and the consumer than through drastic and radical legislation

He says that he finds the conditions under which milk is produced about Los Angeles are not materially different from conditions in other populous centers, except that nature is possibly kinder in granting more sunshine and less rain and a more porous soil, all of which tend toward an easier cleanliness

What advice he has to offer, therefore, is applicable to all parts of California. He hopes especially that the man who is producing and selling directly to consumers in the smaller towns and cities, whether he has one cow or more, may receive an incentive to have better cows and keep them in a clean and a healthy condition

In cities like Los Angeles and San Francisco, he says, where large wholesalers act as distributing agencies between the producer and the consumer and pasteurize all the milk, some of the dangers that might result from disease of the cow and uncleanliness are obviated

"It does not have a pretty sound," continues the professor, "to say that lack of care on the part of the producers is partly the reason for the expensive pasteurization which the wholesalers now give to milk."

"Pasteurization, however, is one of the advance steps toward a healthier race, and some day this process will give way to such clean methods of producing milk that it will not be necessary That is the goal toward which we are all striving '

"It costs money to produce clean milk, which cost must be met by a higher selling price or by more profitable cows, or both The cow is especially in our mind just now, and we call the reader's attention to records taken from different sources to show by actual figures how cows vary in returns to their owners from similar outlay for food and care"

Prof Anderson then refers to the subject of proper stables and corrals for dairy cows and says

"The great thing to be desired in either, is that there should be easy means of keeping clean and then keep them clean. This is the chief reason for using concrete in stable floors It does not decay and then cause foul odors, and it can be hosed down with water and swept in a few moments, so that no dirt remains. Some dairymen object to cows standing on concrete, but in California, where the cows are in only for feeding and milking, they suffer no injury

"Occasionally a very good stable is constructed where the cattle stand, which portion is made of plank This works well from a sanitary point, if the planks are water-tight or are underlaid with a water-tight substance so that the soil under the planks cannot become saturated

"A milking stable is absolutely essential to the production of clean milk Milking in the corral is an abomination, either in winter or in summer In winter, during the rainy season, it is not uncommon to see both cow and milker wading nearly to the knees in mud, when of necessity the milk must become the depository for some of the mud.

"In summer, when the corral dust may be from one to four inches deep, the condition is even worse The dust is raised with any slight breeze or with every movement of man or beast, and even more dirt finds its way into the milk than during the time of rain and mud Thus the cows must be provided with some stable which is dry and clean, and where they can be held for milking

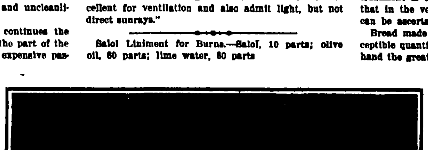
"The stable needs not be expensive On the contrary, it may be very simple, and the less lumber in it the better so long as the frame is sufficiently strong It should permit the entrance of an abundance of direct sunlight and have enough openings to give constant ventilation Large louvers in the roof are excellent for ventilation and also admit light, but not direct sunrays."

Salol Liniment for Burns.—Salol, 10 parts; olive oil, 60 parts; lime water, 60 parts

Bread Under the Microscope.

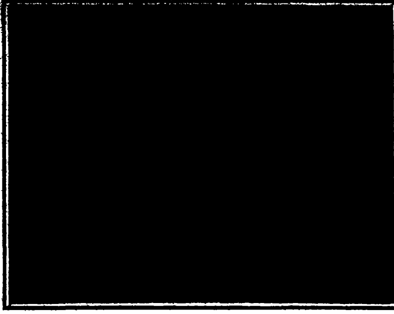
Bread, like milk, is one of the most general articles of food, and as such is subjected to the most frequent adulteration, and unfortunately it happens that such a fraud cannot always be detected with ease. The experts who have given especial attention to this kind of adulteration agree in the statement that under the influence of the preparation of bread the grains of flour undergo certain changes in their outer appearance that render them much less distinguishable. In a most praiseworthy article recently published in Les Annales de la Chimie Analytique, Eugène Collin recounts the results of his tireless examination of pure bread and adulterated bread. In the course of his laudable endeavor, it seems, he found himself able to determine with passable exactness the quantity of pure flour in baked bread, whether the bread subjected to microscopical examination was old and hard or fresh His procedure was to soften a crumb of bread with as little water as possible and knead it persistently with forefinger and thumb over a fine sieve resting on a vessel that should receive the dripping water The mass is treated in this manner until the water ceases to look darkened A powdery mass then remains on the sieve, which is deposited on the crystal of a watch, combined with a trifle of glycerine, and is then set aside for further examination Besides, to the water in the vessel is given an opportunity to clear itself, and it is then decanted so carefully that the sediment is not disturbed The result of such treatment is that from the deposit on the sieve and that in the vessel the true composition of the bread can be ascertained.

Bread made from pure flour leaves only an imperceptible quantity of starch on the sieve On the other hand the greater part of the gluten is found on it and forms a net of irregular meshes and shows some resemblance to vegetable tissue In consequence of the ease with which its presence in the bread is ascertained, the gluten is especially important for microscopical examination. In the same deposit the microscope showed numerous particles of starch which during the preparation of the bread changed their ordinary form or were forced to explosion. Still there is a rather considerable number of them that have escaped this influence and are easily recognized from their size, color, form, and the presence of the navel. These statements regard wheat bread only. The result when rye bread passes under the same procedure is that the deposit on the sieve consists of gluten only, and therefore proportions in a mixture of both kinds of flour can be ascertained with a large degree of exactness under the microscope. Particularly, however, is this done through a test of the precipitate of flour, since the grains of starch of wheat and of rye are [illegible]

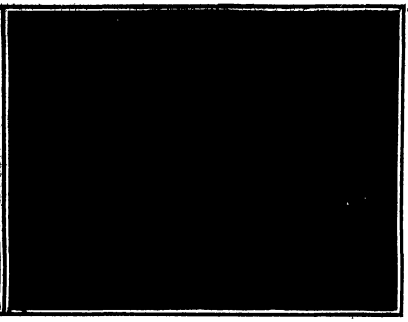


Lecture in agricultural and horticultural demonstration train.

A RAILWAY [illegible] FARMERS.



Dairy exhibit, agricultural demonstration train.



Cereal exhibit, agricultural demonstration train.

A RAILWAY SCHOOL FOR FARMERS.

placenta. The most resemblance to these is shown by the grains of barley, the addition of which is ascertained with a satisfactory degree of certainty from the precipitate on the sieve. A quite customary adulteration of bread is effected with rice flour, which always fails to escape the scrutiny of the microscope when this is invoked, for the grains of starch of rice are always left in great number on the sieve and are more easily recognized because during the preparation of bread they suffer less change. This result of M. Collin's investigation is extraordinarily important, for the addition of rice flour to wheat flour or to rye flour has begun to be a veritable torment. Besides, certain kinds of corn meal have been misused in the same way, though easily detected by the microscope.

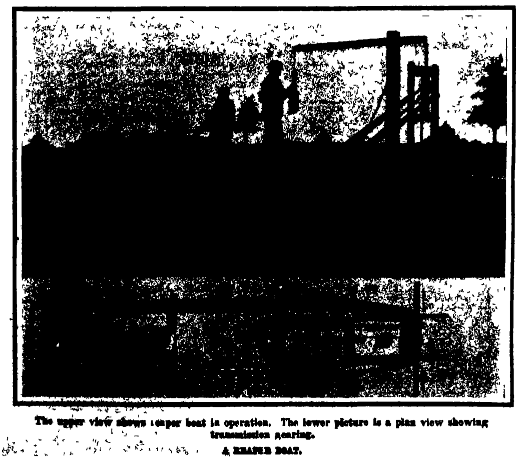
A REAPER BOAT

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN

A French constructor, A. Amiot, has brought out a type of boat combined with a set of cutting blades, which is designed for use in cutting off aquatic growths in ponds or artificial lakes, mill races and various water courses. Such operations are often necessary where the bottom of a pond or water course becomes obstructed by the thick growth of aquatic plants, but where it is required to be carried out by hand labor it becomes a difficult and also an expensive matter, especially where a large area has to be dealt with. M. Amiot's device overcomes the difficulty by using an internal combustion motor mounted on a boat, and the motor serves to drive a set of cutting blades, which are designed somewhat after the fashion of reaper blades and adapted in their form so as to carry out the cutting of the plants under water in the best manner. The boat is rather narrow, and flat bottomed, being much narrowed at the front and the rear. In the front is carried a paddle wheel, which is run by a gasoline motor, which drives the boat at a slow speed. Its total length is about 20 feet.

The cutting bars are mounted at the lower end of a vertical frame, which is held at the rear end of the boat, and these extend transversely across the bottom of the frame so as to lie at a point near the bottom of the water course or pond and to cut off the plants as the boat advances. Such bars are made in different lengths and also at different curvatures so as to be adapted for flat bottoms or for beds of streams of different forms and sizes. The bars are usually from 6 to 12 feet in length, and are designed to cut off a considerable area at a time. This gives the present system a great advantage in being able to cover a large surface within a short time and at a comparatively small cost. As will be observed in our engraving, the frame, which is made up of two vertical angle irons braced in the proper way, is suspended at the end of the boat, and [illegible] being swung upon the end of the lever, which is observed at the upper part, and this lever is pivoted in an upright. By means of the counterweight at the end of the lever, the entire frame can be raised and lowered, and this gives the adjustment of the cutting bars at any desired height in a convenient way. The gasoline motor is placed at the other end of the boat, and there is a belt transmission running to the rear end, which operates the pulley placed in the upper part of the cutting bar frame. This does not interfere with the raising or lowering of the frame, as will be noticed, seeing that the belting and pulleys can work at different angles. On the shaft of the pulley is a crank which drives a rod, and this last passes down along the frame to the lower part, where it connects with a rack and pinion movement. By means of the alternate up and down movement of the rod, and the rack and pinion at the lower part the cutting blades are given the to and fro movement in the same way as is seen in the usual blades, and in this way a wide swath is cut under water and at any desired height above the bottom. The paddle wheel is carried on a frame which is adjustable by means of bolts, so as to give the paddles any desired immersion, and the gasoline motor drives the wheel by gearing and chain device, using two separate countershafts for this purpose so as to give the needed speed reduction. The gasoline motor is operated at the standard speed of 500 revolutions per minute. When it is required to take the boat into shallow water or otherwise to pass over rocks or other obstacles, the cutting frame can be lifted entirely out of the water. In this case the cutting bars are folded up along each side of the frame so as to occupy but little space. In usual practice the cutting is carried out at the rate of 1½ miles an hour, and the cost of operating is estimated at $0.25 per mile, comprising gasoline, oil, labor, together with depreciation and maintenance. For cutting one acre area, the cost is figured at $2.70.

The Amiot system is meeting with great success in Europe, and it is now in use on the artificial lakes of the domain of the Institute of France, at Chantilly, and also on the domain of Laeken, belonging to the King of Belgium. It is also used on a number of canals and rivers in France.



The upper view shows reaper boat in operation. The lower picture is a plan view showing transmission gearing.

A REAPER BOAT.

According to the Electrical Review and Western Electrician, the Park Building at Pittsburg, Pa., which is 15 stories high and contains 400 offices, was recently lighted by carbon filament lamps and had its interior decorations painted a deep sea green color. It is now lighted by tungsten lamps, and has its interior painted a light buff color. On replacing 3,910 carbon lamps (56-watt) by 780 100-watt and 200 25-watt tungsten lamps, and 21,840 watts in 16 and 32 candle-power carbon lamps in the corridors and lifts by 8,400 watts in 40-watt and other tungsten lamps, 149.4 kilowatts is saved.

THE ELEVATOR INSTALLATION OF THE METROPOLITAN LIFE TOWER.

BY HERBERT T. WADE.

In the newly-completed Metropolitan Life Insurance tower is to be found an example of an installation which serves the purpose of lifting cars to an altitude greater than that attained in any building yet constructed Judged independently of its height, the installation is a model of modern elevator engineering Furthermore, it is significant of the successful development of a comparatively recent type of elevator machine which has been tested in actual use and found to answer the requirements of service as well as the requirements of mere height. Great as the lift is the designers claim that it is possible to go even higher and that elevators can be installed in any skyscraper which the ambitious architect may yet essay As a result of this engineering achievement there is no difficulty in renting offices far above the city's noise and dust. No more time is consumed in reaching the 44th story of the Metropolitan tower than the 12th floor of older buildings.

For the Metropolitan Life tower, the type of elevator selected was the Otis traction overhead machine, in which the motor and driving sheaves are situated directly above the hatchway High up in the apex of this white marble campanile are to be found powerful electric motors, whose installation at this elevation taxed the ingenuity of the architect and engineer They are without doubt the highest motors working in any building

The problem of high rise in a tower building is one that can be solved by but few types of elevators. A height of 400 feet marks the limits of the plunger and other hydraulic machines In many forms of electrical elevators the weight of heavy moving cables or other parts, and the exact regulation of the car or load, are difficult if not impossible of attainment when certain heights are exceeded In the Otis system illustrated we have a simple machine that has been found to work with ease, safety, and reliability A motor is mounted at the top of a shaft or hoistway The armature shaft carries between its two bearings a driving sheave around which the six cables suspending the car are passed One end of the cables extends to the car, the other to the counterweight, which moves up and down in guide rails at the side of the shaft, and is equivalent to the weight of the car and its average load Directly below the driving sheave is fitted an idler sheave, around which the supporting cables are laid, so that it passes again around the driving sheave with which it is in contact for two half-turns When the current flows through the motor, the armature rotates and moves the car up or down as desired When the current is cut off powerful automatic shoe brakes are applied to hold the driving sheave A compensating cable in older installations a chain is connected with the bottom of the car, extends to the bottom of the shaft, passes around sheaves or pulleys, and then extends to the counterweight Its object is to compensate for the weight of the supporting cables, whether the car is at the top or the bottom of the shaft. In other words, the system is very nearly in equilibrium, and the function of the motor is merely to move it with such additional load as is supplied by the passengers in the cars. When the Metropolitan installation was considered by a board of elevator engineers it was realized that this system was the only one that would meet the conditions demanded in an office building of extreme height The thorough tests which the machines have received since their completion has justified the engineers in their selection

The Tower installation, which is quite independent of the elevator systems serving other parts of the huge Metropolitan Building consists of six express elevators, which make no stops between the street and the 10th floor The cars are arranged in the center of the tower in two banks or rows of three each, five of the six running from the 1st to the 41st floor, or a rise of 524 feet 11½ inches. The middle car on the east bank runs from the basement to the 41st floor, while the middle car in the west bank runs from the basement to the highest landing in the tower on the 44th floor, a distance of 586 feet 5¼ inches. With a live load of 2,500 pounds, or about 16 passengers, the cars can make a speed of 600 feet per minute without stops, which is the maximum permitted by the present New York Building Department regulations. Thus the journey to the top floor consumes but a few seconds under a minute which is recognized as about the limit demanded by office building renting conditions. The actual consumption of time by the passenger does not place the tower building at any disadvantage over lower buildings, where slower speeds and frequent stops may require the same expenditure of time. In this connection it may be remarked that the traction machine illustrated can accelerate from a stop to full speed in from two to three seconds smoothly and evenly, so that the passenger experiences no unpleasant sensation

Each elevator is expected to travel up and down daily a total distance of 25 to 30 miles. The [illegible] of the engineer naturally centers in the [illegible] have been installed at the top of the tower under most extraordinary conditions; for as the view of the tower shows, the tapering top affords little space for heavy machinery.

Elevator installation was not a final feature of the construction of the tower, but an ever-present condition. As fast as the structural workers completed the framework, the rails for the cars were set in place, and a temporary elevator was rigged to send up the materials of construction As the material for the five machines for the elevators running to the 41st floor could be carried up by the high-rise elevator, their erection was not so difficult a matter When it became necessary to raise the machine for elevator No. 2 up to the 45th story, a serious problem was presented. Eventually, the task was accomplished, and the huge castings and armature were sent up to a point where they could be set in place by an ordinary tackle. These machines weigh 21,000 pounds each in the case of four, and 23,000 pounds each for two elevators where devices are employed to enable extra heavy loads, such as safes, to be raised The magnet controllers weigh 2,000 and 2,200 pounds respectively for the two classes of machines. It is here that the operation of the switches governing the motors centers, which switches are under the control of the car operator

The motors are rated at 40 horse-power and use 115 volts direct current. They run at a speed of from 35 to 58 revolutions per minute, and the peripheral velocity of the driving sheave on the armature shaft gives the speed of the car The limited space in a high tower presents problems quite different from those of a large building, such as that of the Hudson Terminal, where the traction machines can be arranged in orderly rank. In the tower one machine may have to be placed above the other, or at an angle perhaps, while the controllers and other auxiliaries must be fitted in wherever a place offers. Consequently, the machinery room of the tower has a bewildering appearance. Every inch of space is utilized Despite crowded quarters, there is the utmost order

Around the driving sheaves pass the lifting and counterweight cables, six in number for each machine. They are ⅝ of an inch in diameter, and each cable has a breaking strength of 20,000 pounds. The length of the several cables for the various cars varies from 575 to 626 feet for the high-rise car Another important cable is that passing through the car to the centrifugal speed governor at the top of the hatchway These are ½-inch cables, and they vary in length from 1 144 to 1,274 feet. Their function is to transmit the motion of the car to the centrifugal governor, which in case of excess speed not only cuts off the power, but causes the safety device of the car to come into play and lock it firmly to the rails. The cars, which vary from 9 feet 4 inches by 6 feet 4 inches to 5 feet 4 inches by 8 feet, weigh about 4,000 to 4,500 pounds each. The counterweight is slightly heavier than the empty car, so that the car is assumed to carry an average load

In the more recent Otis traction elevators, the clanking chain used to compensate the weight of hoisting and counterweight cables has been supplanted by a special flat wire rope, which is 3¾ inches wide and ¼ of an inch thick, one end being attached to the bottom of the car and the other to the bottom of the counterweight This cable passes over flat flanged sheaves, arranged in a channel-iron frame at the bottom of the shaft, which frame is carried in such a way that the sheaves are free to move up and down as the hoisting ropes stretch or contract. Two of these compensating cables are attached to each elevator, their length varying from 578 to 630 feet.

Safety no less than speed is insured for these express elevators. Thus the speed governor already referred to serves to actuate a wedge-clamp device on the car, and to limit the speed electrically to 700 feet per minute. If a speed of 800 feet per minute is reached, the wedge-clamp safety device works at once, and the car is clamped to the rails. Furthermore, each car has an emergency brake which enables the operator to shut off the power and clamp the car to the rails independently of the speed governor At the top of the shaft, safety retarding devices check the speed of either car or counterweight in case the ordinary limit of travel is exceeded.

Both cars and counterweights land on patented oil buffers at the bottom of the shaft, which buffers are arranged so as to stop the cars when running at full speed, that is, under 800 feet per minute, and these have been found to work by actual test most effectively and satisfactorily.

The Suez Canal is quite a different affair to-day from what it was when it was opened in 1869. Mr. Vice-Consul Dunlop gives some interesting details of how the canal has been developed to meet the requirements [illegible] ing places, the dredging having been so carried out as to exceed the limits originally decided upon. From 1896 to 1904, owing to the increased dimensions of ships, larger gares were begun, some 20 in number, at intervals of three miles, each gare having an effectual length of 820 yards, with approaches of 325 yards at either end. At each gare the bottom width of the canal is 50 yards, the width at the water level being over 100 yards, while the depth of the gare itself is 31 feet. At the same time the depth of the channel was increased, so that on January 1st, 1902, a draft of 26 feet 2 inches was allowed instead of 25 feet 7 inches. On January 1st, 1906, the draft for ships was again increased to 27 feet, and on January 1st, 1908, to 28 feet. The work of deepening the channel is steadily proceeding, with the intention of arriving at a uniform depth throughout.

An Ingenious Way of Examining the Contents of the Duodenum.

The lay mind is apt to consider the advances made in surgery in the last decade of more importance than those in modern medicinal practice. That this popular impression is erroneous is proved by the many devices which have of late years been put to successful tests to enable a physician to examine with the greatest accuracy the workings of inner organs and to restore them to their normal condition without resorting to the surgeon's knife. Notable forward strides in this direction have been made in the study of the digestive organs of the human body, such as examination of the stomach and its contents by the use of a bucket firmly held at the end of a fine cable and let down into the stomach, to fill and be hauled up again for examination by chemical reaction tests, to determine whether the stomach digests normally or abnormally, and thus to enable the physician to diagnose correctly the defects or diseases of the digestive organ

From the New York Medical Journal we learn that Dr Max Einhorn, professor of medicine at the New York Post-Graduate Medical School, has succeeded in obtaining samples of the chyme contained in the duodenum by the use of a very simple apparatus called the "digestive juice aspirator," a portion of which instrument is introduced into the duodenum by way of the esophagus and stomach without the slightest discomfort to the patient.

It is well known that primary digestion takes place in the stomach, but the most important digestive action takes place in the duodenum that is, the part into which the stomach discharges by way of the pylorus, and which also receives the very important secretions from the liver (bile) and the pancreas.

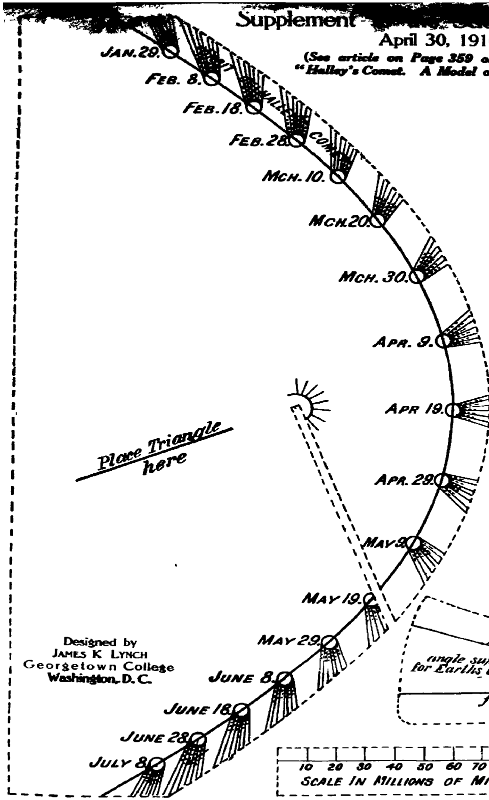
For the purpose mentioned, Dr Einhorn uses a thin flexible tube terminating in a small metallic perforated capsule, which is swallowed by the patient and passes into the stomach, dragging the flexible tube along in its descent, the tube being sufficiently long to extend a distance out of the patient's mouth.

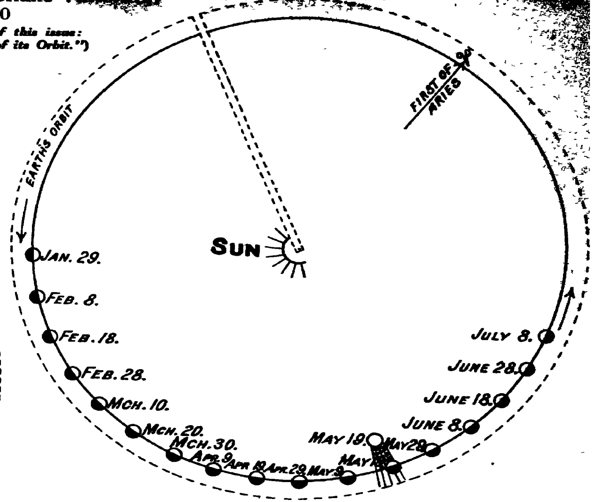
The capsule in the stomach is acted on by the movement of the stomach wall, as in the case of food. In the course of about an hour it passes by way of the pylorus into the duodenum, and even as far down as the beginning of the small intestine. The outer end of the tube is then connected with a small hand suction pump, the piston of which is gradually withdrawn, so that the duodenal contents are drawn into the perforated capsule and up through the tube into the glass barrel of the pump, which latter is now disconnected from the tube and its contents emptied into a vial for examination. The tube and the capsule attached thereto are then withdrawn.

The immense importance of being able to obtain the chyme directly from the duodenum, especially the lower part thereof, is apparent, as the physician by the subsequent tests made of the chyme obtained, can diagnose accurately and readily determine the proper or improper functioning of the duodenum. The same instrument can, of course, also be used in the stomach, to obtain samples of gastric secretions, during the entire period of stomach digestion, from beginning to end.

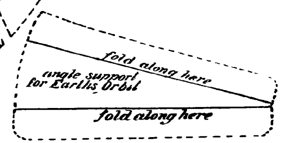
The successful use of the simple device described has led Dr. Einhorn to its reverse use, that is, introducing food or medicine directly into the duodenum without first passing it into the stomach, in the ordinary way of swallowing the food or medicine. In this case, the food or medicine in liquid form is filled into the barrel of the pump and after the introduction of the perforated capsule into the duodenum as above described, the pump is attached to the outer end of the tube, and the pump is actuated by [illegible] force the food or medicine through the tube and perforated capsule [illegible]

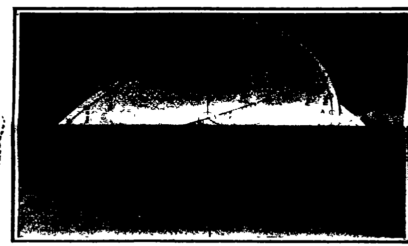
(See article on Page 359 of this issue: "Halley's Comet. A Model of its Orbit.")





Designed by
JAMES K LYNCH
Georgetown College
Washington, D. C.





Paste this sheet on a piece of 10-ply cardboard. Cut out the three diagrams along the dotted lines. Slot the planes of both the comet's and earth's orbits along the dotted lines running from the sun to the orbits. Insert the planes into each other, keeping the earth's orbit below that of the comet on the right, but above it on the left. The general effect is shown in the photograph. To hold the planes at an angle of approximately 18°, paste two small muslin hinges in the angle between them, one on each side of the sun, keeping the slots in line. Bend the flaps of the triangular angle support along the lines indicated, and paste the support as a wedge between the plane of the earth's orbit above and the comet's orbit below

HOW TO MAKE A MODEL OF THE ORBIT OF HALLEY'S COMET, SHOWING ITS RELATIVE POSITION TO THE EARTH'S ORBIT

Correspondence.

WEIGHT DISPOSITION IN AEROPLANES.

To the Editor of the SCIENTIFIC AMERICAN

I was much interested to read the letter of C E. McCluer of Norfolk, Va. in your issue of April 9th concerning monoplanes and the disposition of weight below the level of the supporting planes.

In a letter I wrote to the Wright Brothers at the time of the unfortunate accident in which a valued officer of the United States army lost his life, I advocated the very principle set forth by Mr McCluer and confidently believe still that the adoption of that method will preclude the possibility of the recurrence of such accidents.

In the letter referred to are sketches illustrating the idea and showing the same in comparison with a bird in the act of flight. The whole thing was submitted without any mercenary motive and was simply for the reason already stated.

As a mere student of aviation I submit the foregoing in the hope that you will publish the same as it may lead to experimentation. ROBERT W MATTHEWS

Lock Haven, Pa.

WEIGHT DISPOSITION IN AEROPLANES.

To the Editor of the SCIENTIFIC AMERICAN

Mr McCluer s letter in the issue of April 9th exemplifies an error only too common among people who take an interest in aeroplanes Placing the center of gravity low in an aeroplane introduces many objectionable features which more than outweigh its advantages. Far from having a stabilizing effect the low center of gravity makes the machine more unstable than ever and calls for great skill on the part of the aviator to maintain an upright position

This is due to the pendulum effect of the suspended weight. When the propeller attempts to accelerate the machine by increasing its forward thrust it is resisted by the inertia due to the machine s weight and if the center of gravity is below the center of the propeller the machine will tip forward

Likewise on a turn the suspended weight tends to swing out in a larger circle than center of the supporting surface where the resistance is concentrated and so tends to depress the inner wing just the contrary of what Mr McCluer assumes would take place This disturbing tendency is in addition to the depression of the inner wing due to its slower speed

Mr McCluer's analogies to natural forms have much that is good in them and like him I favor the monoplane but I believe that soaring birds will be found on closer observation to keep their weight well up on their wings The only safe principle for an aeroplane is to have the centers of gravity thrust and support as nearly as possible coincident

New York G H GOSLEY

THE "KINKS" IN THE NEGRO S HAIR

To the Editor of the SCIENTIFIC AMERICAN

The texture of the hair is one of the physical variations differentiating the negro from the Anglo-Saxon Celt or Teutonic races But what causes the kink in the hair of the negro? For centuries and centuries the ancestors of the United States negro have lived in the dense forest and heat of the torrid zones of Africa the atmosphere of which has been surcharged with sodium calcium magnesium sulphureted hydrogen ammonia iron and other chemical substances Besides these and other known metals the atmosphere has in it various gases which it holds in suspension In the presence of these atmospheric solid and gaseous substances coupled with a constant very "humid condition" of the atmosphere we have the unprotected scalp of the indigenous native with the powerful actinic rays and heat of the tropical sun acting directly upon the head of the Homo Africanus both as an irritant and a trauma This excites a condition known to the pathologist as an inflammation With this condition of inflammation of the skin of the head there follows a congestion and proliferation of the blood vessels of the skin of the scalp with the following result The sudoriferous and sebaceous glands together with their excretory ducts become hypertrophied This makes the entire dermis and epidermis thickened and indurated as the glands of the skin pour their contents out upon the surface of the skin to go through the process known to chemists as oxidation, which produces heat According to the well known principle cold contracts but heat expands, there occurs an alternate contraction and dilatation of the longitudinal and transverse bands of connective tissue and the thin muscle fibers that connect the papilla, in which the shaft of the hair is growing This alternate contraction and dilatation of the muscle [illegible] acts as a sort of a "pull-rope," pulling the [illegible] and shaft first in one direction and then [illegible], with the following result The hair as it grows from the root to the epidermis, becomes [illegible] an oval shaped The shaft of the hair, as it [illegible] [illegible] [illegible] [illegible] its oval [illegible] in the [illegible] of the [illegible]

[illegible]

The heat generated by action of the integuments of the skin in the presence of the atmosphere tends to harden the outer sheath of the hair and gives to it its permanent character

In the temperate zone of the United States where the humidity of the atmosphere is not so dense with our abundance of sunlight where the atmosphere is not so heavily impregnated with metallic corpuscles and gaseous substances and where the Afro-American s head and scalp are protected by the ordinary head gear removed also from beneath the direct rays of the torrid tropical sun the etiological factors which have been operating for ages and ages to make the Afro-American s hair *encomic* will in time make his hair enthycomic. The modern science of anthropology no longer teaches that Homo Europeaus is of an "Indo-European origin but Sergi makes the affirmation that Homo Caucasicus is of a Mediterranean origin Ripley (see Races of Europe p 175) The Mediterranean population are an offshoot and development from the African negro (See Darwin s Descent of Man, p 171) The probable and acceptable hypothesis is stated by Arthur M Marshall in his biological lectures 1894 p 24 who says The white races of Europe had their geographical genesis in Africa and spread thence in paleolithic and neolithic times over the whole of Europe The white races of Europe and America are therefore of a negro origin and the same causes and elements of nature that have depigmentized the skin and straightened the hair of Homo Caucasicus will in time produce the same results in the Afro-American s skin and its append ages J M BODDY

St. Paul, Minn

HALLEY S COMET—A MODEL OF ITS ORBIT.

BY JAMES K LYNCH GEORGETOWN COLLEGE

For the large number of people now interested in the famous Halley s comet who have found difficulty in obtaining an intelligent idea of its motion in space its apparent motion in the sky and the times of its visibility a cardboard relief model like that of which a photograph is herewith reproduced will be of great assistance And even those who already understand the phenomena from the study of plane diagrams may obtain a much clearer idea of them from the model because it is much more concrete and represents the sun and the orbits of the comet and the earth as they really exist in space and not as they are often shown by being projected on the same plane

In order that the readers of the SCIENTIFIC AMERICAN may easily construct such a model for themselves patterns or diagrams are printed on the accompanying loose-leaf supplement which when pasted on card board cut out and properly fitted together will make an excellent model

After telling how to construct the model some description will be given explaining how the astronomical phenomena may be studied from it

Having first pasted the loose-leaf on a sheet of card board about 10-ply cut out the three diagrams along the dotted lines Also cut a narrow slot through the planes of both the comet s and earth s orbits at the places marked Then insert the planes into each other as far as the slots will allow keeping the earth s orbit below that of the comet on the right but above it on the left.

If the two planes are correctly fitted together they will now produce the general effect shown in the photograph But besides having the model rigid the two planes must be given the necessary inclination to each other of approximately 18 degrees

Fasten the two planes together by pasting two small muslin hinges in the angle between them one on each side of the sun keeping the slots in line Then bend ing over the flaps of the triangle along the two lines marked on it paste it as a wedge between the plane of the earth s orbit above and the comet s below This completes the model

The reader will observe that the comet s position is indicated at intervals of ten days before and after perihelion as it travels in its orbit in the direction of the arrows The earth s position as it yearly moves about the sun in the opposite direction is also shown for the same days The printed side of the model faces north

Examining the comet s path in space we see that it cuts through the plane of the ecliptic at the ascending node symbol ☊ in January On April 19th it was at perihelion On May 18th 19th it cuts through the plane of the ecliptic at the descending node

During the early part of the year the comet and the earth moved on roughly parallel lines Hence the comet grew brighter only by a change in its intrinsic brilliancy Now however the orbits are rounding in toward each other and the comet will be more conspicuous because it is approaching the earth

The tail is always directed away from the sun Hence in March it was much foreshortened for us Now it is becoming more nearly perpendicular to the line of sight, and will soon be seen more in its full length.

The time of visibility of the comet will depend on whether it is to the left or right of the sun as seen from the earth To transfer correctly to the sky left and right on the model we should imagine the sun on the meridian at noon with the comet to the left or right. Taking the way that common observation shows the sun to move across the sky from east to west on account of the earth s daily rotation it is easy to see that any body that is to the left of the sun at noon will rise and set later than the sun and anything to the right at noon will rise and set earlier than the sun

Hence before March 25th the comet being to the left of the sun rose in daylight but set after the sun and was visible in the evening At present it is to the right of the sun and rises before it in the morning increasing its distance until May 8th when it reaches its greatest western elongation It then approaches the sun and comes into inferior conjunction on May 18th 19th

As the three celestial bodies are also in the same plane on this date the circumstance makes it possible for us to go through the comet s tail if it is long enough to reach us What we shall see on that night it is not the purpose of the present article to consider but it may be said that as the moon is then approaching full a fact which has been somewhat overlooked we may not see anything at all

The comet and the earth are fourteen million miles distant May 18th 19th but their closest approach occurs a day later when they are thirteen million miles apart The closest approach of the orbits is at a point a little below to the left where the comet s orbit is six and one half million miles below the earth s On diagrams where both orbits are projected on one plane they apparently intersect at this point Hence some people have imagined a possible collision here but the orbits never intersect as the model shows

On and after May 20th as the comet is to the left of the sun in the model it will again be visible in the western sky being seen as soon as it is dark enough and setting about two hours after sunset which time will gradually increase to four hours by the end of May But as the two bodies are then receding in almost opposite directions and the tail is turning more and more away from us the glory of Halley s comet will soon be lost to us for three-quarters of a century

The Current Supplement

The new 60 it h reflecting tel s ope of the Mount Wilson Solar Observatory has been in operation for about one year A d s ription of this wonderful instrument and the work which it does is presented in the current SUPPLEMENT No 1 91 by F A Ellis Sven Hedin s big Trans Himalaya is reviewed Halley was not only the first to predict the return of a comet but also to devise a method of determining the age of the ocean from chemical denudation George F Becker comments on his work The ancient decimal bead frame is still in actual use side by side with the very latest adding and listing machines This ancient bead frame the Chinese abacus and its Japanese twin brother are describ d by Mr Daniel Arthur Dr Jean Charcot presents th results of his Antarctic expedition Henry A Wise Wood contributes an excellent paper on Mod rn Stereotyping and the Mechanics of the Newspaper Substitutes for Rubber is the title of an article which must undoubtedly attract attention because of the present rubber boom Under the title Mechanical Oddities some curious inventions are described The design of aeroplane motors is discussed A Melin suggests an improvement in aeroplanes A box with a secret opening is described and illustrated

Mercury Arc Patents Granted

After six years patent Mr Peter Cooper Hewitt has been awarded patents for his mercury vapor electric lamp The patents have been in interference almost since the date when they were first applied for in 1901 Mr Hewitt s chief opponent was the General Electric Company

In accordance with the recent decision affecting the classification of articles under the Tariff Act of 1909 the United States Treasury Department has instructed customs officers to admit free of duty all miners safety lamps whether electric or designed for using oils or other illuminating materials with or without glass chimneys and whether imported as an entirety or in separate parts together with any apparatus for locking or unlocking such safety lamps for testing or detecting flaws in these lamps or for cleaning them of dust particles etc together with all mine rescue appliances and parts thereof such as helmets special tubing of valves special oxygen cylinders refilling oxygen pumps and all other essential parts of the complete outfit, whether imported as entireties or in separate parts.

THE MOTOR-BOAT RACES AT MONACO

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN

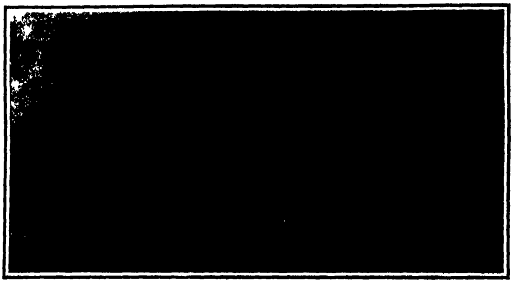
The motor boat races at Monaco and Monte Carlo this year were noteworthy on account of the extremely high speed which was attained according to the cable dispatches. There were a score or more of boats in the races which were favored with excellent weather that made possible the attainment of great speed especially in the long-distance events.

The first long distance race for the Championship of the Sea was held on Sunday April 10th. Count de Pourtales' Cocorico readily won this 200-kilometer (124 mile) race in 4 hours 22 minutes 35 2-5 seconds at a speed of 28.31 miles per hour. Out of the 26 competitors in this long distance race for cruisers the Telc Mors, Calypso, Gregoire VIII and Spagal Ilnail finished in the order given.

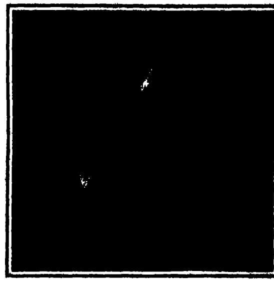
The race was an exciting one as several of the boats were quite evenly matched. The Brasier Despujols hydroplane, which was one of the novel craft that raced this year, did very well and showed good speed in proportion to its horse-power. In the second great international race for the Coupe des Nations which took place on April 12th this boat was second, finishing but 7 minutes and 47 seconds behind the Ursula which completed the 100 kilometers (62.1 miles) in 1 hour 26 minutes 59 2-5 seconds. The Brasier Despujols averaged 39.1 miles an hour against 42.88 miles an hour of the Ursula. She was fitted with a Brasier 4-cylinder engine of 100 horse-power, while the Ursula had two 12-cylinder motors totaling 800 horse-power. One of our photographs shows the twin screws of the Ursula. Her engines are arranged side by side one on each side of the hull. Another photograph shows the Ursula at full speed, while a third picture shows the Brasier Despujols. The difference in the amount of spray thrown by these two boats is interesting; the former cuts through the water with very little disturbance, while the latter skims over it with a good deal of splashing. The great regularity with which the Ursula speeded around the course for nearly an hour and a half astonished many of the spectators, and was an excellent testimonial to the design and construction of the Wolseley-Siddeley motors that drove her. She was piloted by her owner who steered her with great steadiness. He took the turns without slowing down and at each turn the boat would tip dangerously. The Ursula showed herself to be one of the fastest motor boats that have ever been built, but in the mile and kilometer speed trials she did not make anything like the time that she is reported to have accomplished in the long distance races. In fact the hydroplane beat her in the speed trials owing to its ability to get under way quicker. The times of the mile from a standing start and of the flying kilometer trials by the Brasier Despujols and the Ursula were as follows:

	Mile	Kilometer	Miles an Hour
Brasier Despujols	2 20		25 71
Brasier-Despujols		50 2-5 sec	44 35
Ursula	2 36 2-5		22 68
Ursula		55 2 5 sec	40 35

The Ursula this year is fitted with the same two 12-cylinder Wolseley Siddeley motors that were used last year. As her best speed then was about 37 miles per hour, it is fair to assume that the figures given in the cabled reports are not correct, or else that the distances around the course were less than supposed. It is extremely doubtful if the Duke of Westminster's racer averaged more than this figure in the long races, especially since she made only 40.35 miles an hour in the flying kilometer speed trial. We understand that on account of the great depth of the water where the races are held there is oftentimes a shifting of the buoys owing to the inclining of the anchor lines, and that this causes a shortening of the course. The mile and kilometer tests are therefore the only ones in which any great degree of accuracy is obtained, and as experience has shown that in a long-distance race a boat will make less speed, if anything, than in a short speed trial, it seems certain that the 'Ursula' has not shown much more than 40 miles an hour so far. That she should have averaged 42 miles an hour with the same power plant as heretofore is very creditable.



Three of the contestants making a turn in the "Championship of the Sea" race



Stern of the "Ursula," showing rudder and twin screws.

An Aeroplane Flight with Five Persons, and Cross-Country Flying in France.

One of the most remarkable performances ever made with an aeroplane was that of Roger Sommer's new biplane last week in France when piloted by its constructor. It carried him and four other persons in a five-minute cross country flight. On this occasion the aeroplane lifted some 750 pounds of dead weight, or probably a total weight of 1,800 pounds, with presumably a 50-horse power motor.

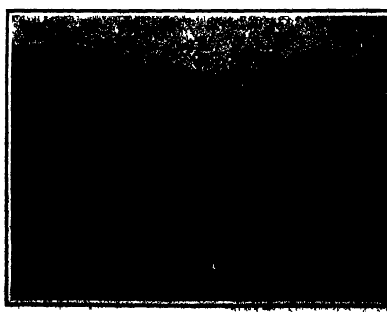
Another demonstration of the development of the heavier than air machine was given on April 1[illegible]th by Louis Paulhan, who flew from Orleans to Arcis-sur-Aube (118 miles) in 3½ hours on his Farman biplane. The next day he flew 42½ miles farther across country in 1 hour and 10 minutes, reaching a height of 750 feet. Henry Farman on the 17th instant also flew 40 miles across country with a passenger.

These brilliant flights form an ocular demonstration of the great advance recently made in dynamic flight, and point the way to the practical utilization of the aeroplane for the transportation of individuals and of mail.

The Electrical World states that at a recent miners' convention in Indianapolis the opposition of mine workers to electric power, the introduction of which they consider against their interests, was manifested in a resolution declaring that the use of electricity in mines is hazardous, as the leakage from poorly insulated wires has a tendency to ignite mine gases and frequently causes explosions.

The Brasier Despujols hydroplane at full speed.

This boat made 44.35 miles an hour in the flying kilometer speed trial.



The Duke of Westminster's "Ursula" speeding in Monaco Bay.

Besides winning the 62.1-mile Coupe des Nations [illegible] an hour in the flying kilometer trial.

THE MOTOR-BOAT RACES AT MONACO.

THE MANUFACTURE OF CELLULOID

BY JACQUES BOYER

More than sixty years ago chemists began the search for substances of which imitations of horn tortoise shell, and ivory could be made One of the first experimenters Dr Pierson of New Orleans furnished a theoretical solution of the problem in 1848 by the discovery of celluloid a complex substance consisting chiefly of nitrocellulose and camphor but no industrial application of celluloid was made until a much later date

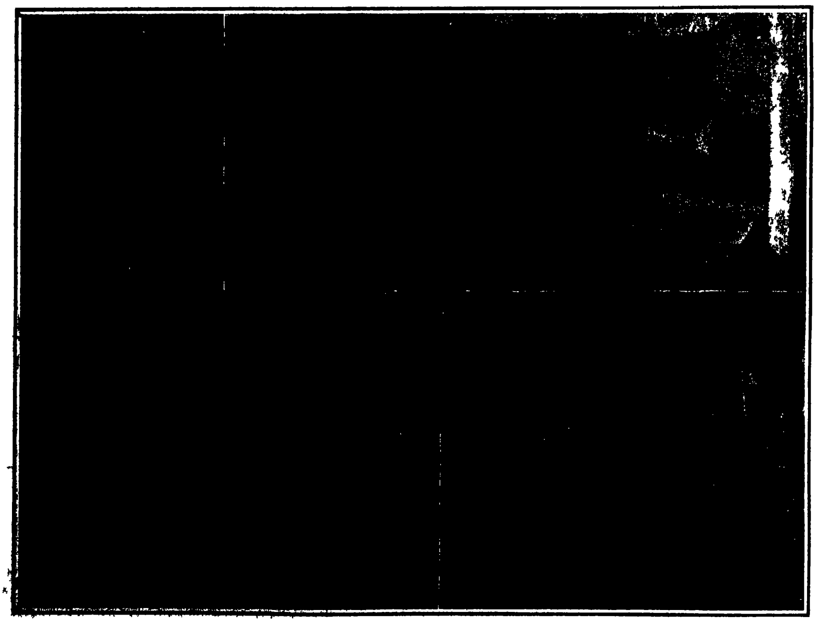
In 1862 Parkes of Birmingham obtained a similar substance which he named 'parkesine by mixing guncotton with wood naphtha The hardness of parkesine limited its applications and it was employed chiefly as an electrical insulator In order to soften it caster oil was added to the mixture and afterward the naphtha was replaced by methyl alcohol Parkesine obtained a temporary success in England but it was driven out of the market by the cheaper celluloid the manufacture of which was begun by the Hyatt brothers in Newark New Jersey in 1867 Other large celluloid factories were subsequently established in America France England and Germany

Celluloid is now made from a very pure form of cellulose usually obtained from cotton or unsized filter paper The cellulose is converted into nitrocellulose by methods which vary somewhat in different factories Among the processes most commonly used is the following The material—raw or spun cotton or paper chopped or cut into strips—is immersed in nitr c acid for a ɿeriod ranging from fiftee n i utes to two hours according to the chara ter of th fib rs and th temperature of the bath The cotton or paper now converted into nitrocellulose is takeı out wruı g and pressed to remove most of the adhering liquid which may or may not be returned to the itrating bath In either case the strength of the bath is r stor d to its origii al value by the addit on of con entrated nitric acid

The nitrocellulose is washed in water and ground in a ɿaper mill in which a rotary movement is impressed upon the mass as it is forced between a ɿla a d two cylinders which rotate at a speed of 160 revolutions

Bending celluloid hairpins.

Blowing celluloid dolls.



[illegible] of celluloid. Rolling sheets of celluloid. Cutting out cellul id rods.

THE MANUFACTURE OF CELLULOID.

per minute The cylinders are set with steel blades, parallel to the axis, and the plate bears a number of steel blades, slightly inclined to those of the cylinders The finely ground nitrocellulose next goes to the bleachery, where it is treated with chlorine, hydrogen dioxide sulphurous acid, potassium permanganate and other decolorizing agents It is then washed thoroughly, pressed between rollers, and dried

Celluloid is made by dissolving nitrocellulose in an alcoholic solution of camphor Some manufacturers mix the camphor with the moist product of the roller presses which contains 40 per cent of water, while others add the camphor to the dried nitrocellulose In the former case the moist pulp, camphor and coloring matter are ground together between horizontal, circularly fluted iron "millstones" The mixture is passed several times through this mill, and is then dried When the nitrocellulose is dried separately the lumps formed in the passage through the roller press are crushed by rubbing the pulp, with the hand through a coarse wire screen

Drying is effected indirectly by pressing the pulp between layers of absorbent material The pulp is spread on a cloth which is turned up over it, forming a rectangular cake 24 inches long 20 inches wide, and about ⅝ inch thick. In the factory of the Société Industrielle du Celluloid these cakes are piled alternately with dry felts a sheet of iron being introduced after each ten or fifteen cakes, in order to facilitate handling The pile is then subjected to a hydraulic pressure of about 250 tons. After a few minutes of this violent compression, the now wet felts are replaced by dry felts and the operation is repeated until the nitrocellulose is dry The compressed cakes are now unwrapped and broken into fragments for solution If the camphor has been added before drying the broken cakes are simply sprinkled with alcohol, but if the dried nitrocellulose contains no camphor it is moistened with a solution of 90 parts by weight of camphor in 100 parts of alcohol

The solvent is allowed to act for 24 hours and then the mass is rolled between hollow iron cylinders, from 12 to 26 inches in diameter, which make 10 revolutions per minute, and are cooled or heated, as desired by a circulation of cold water or steam in their interior From 65 to 130 pounds of celluloid are rolled at a time the rolling being continued from half an hour to several hours Toward the end of the operation the cylinders are brought close together in order to produce a thin sheet of celluloid longer and wider than the press by which the sheets are converted into blocks The rolled sheets are trimmed to the exact dimensions of the press, and the trimmings go back to the rolling mill

In the Champigneul block press a strong iron box 54 inches long, 26 inches wide and 12 inches high is filled with sheets of celluloid and these are converted into a single block by pressing between two iron plates The top plate is fixed in position, while the bottom plate is carried by a plunger which enters a cylinder below and is forced upward by hydraulic pressure A pressure of 250 tons is applied for a period varying from 5 to 12 hours, during which the celluloid is kept at temperature of from 158 to 194 deg F by a circulation of hot water in the interior of the plates and the double walls of the box The mass is cooled by substituting cold for hot water the pressure being continued during the cooling The top plate is then removed and the block of celluloid is forced out of the top of the box by again applying pressure from below

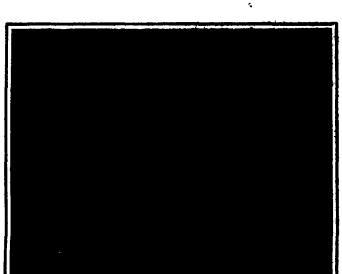
The blocks are cut into bands or rods according to the purpose for which the celluloid is to be used The bands are cut by a machine in which a knife, the edge of which is inclined 40 degrees to the horizontal, is forced downward by a screw In this way bands varying in thickness from 1/250 inch to 1¼ inch can be obtained. Celluloid is cut into rods or fibers by a machine in which the cutting tool has the form of a short cylinder of diameter varying according to the size of rod desired

The celluloid, after it is cut up is dried in chambers where the temperature is never allowed to exceed 113 deg F on account of the danger of explosion The time required for desiccation varies greatly with the thickness of the bands or rods Bands thinner than 1/100 inch dry in a few hours while strips thick enough to be used in making knife handles, for example must remain in the drying chamber about six months.

Tubes of celluloid are made directly from the rolled sheets in an apparatus which comprises two vertical cylinders, with their axes in the same line and their pistons connected by a stout rod. The bottom of the lower cylinder has a central orifice, to which annular apertures of various dimensions can be adjusted, and the lower part of the cylinder is heated by a circulation of hot water. The celluloid is introduced into this cylinder and hydraulic pressure is applied by means of the cylinder above. The celluloid, softened by the heat, is thus forced through the aperture in the form of a tube, which the operator draws away and cuts into convenient lengths by means of a clamp attached to a cord passing over reversible pulleys.

To return to the bands of celluloid which have been cut from the pressed blocks. In the drying chambers these bands become warped. They are flattened in a hydraulic polishing press which exerts a pressure of about 1,000 tons. The celluloid bands are piled alternately with sheets of polished brass or nickel-plated steel, a thick plate of cast iron covered with cloth or felt being inserted after each four or five bands. These iron plates contain channels for the circulation of steam or cold water While the pressure is applied the plates are first heated by steam to 180 or 190 deg F for a few minutes and are then cooled by cold water When the bands are taken from the press they are found to have acquired the high polish of the sheets of metal which were in contact with them.

Before describing the subsequent transformations of the bands rods and tubes of celluloid, the method of producing striped, veined, and marbled effects should



Flattening celluloid bands that have warped in drying.

THE MANUFACTURE OF CELLULOID.

be noted For this purpose two blocks of celluloid of different colors are made separately in the block press and cut into bands about 1/100 inch thick A pile of these bands, arranged in alternating colors, is sliced with a powerful paper knife. The fine strips of celluloid of two colors resulting from this operation are arranged regularly or irregularly in the block press and converted into a solid block of striped, veined, marbled or "watered" appearance

From the bands, rods and tubes of plain and variegated cellulose, objects of every form and character, presenting the appearance of ivory, tortoise shell, mahogany and other woods, coral, amber, jade, malachite, silken fabrics, etc, are made by various operations, of which the most important are shaping, cutting out molding, curving, blowing, varnishing and decorating.

Celluloid, like wood, horn and ivory, is usually shaped by hand, with the chisel, drawing knife, rasp, etc. Celluloid hair pins are pointed on the emery wheel Shaping is done also on the lathe in the factory of the Société Industrielle du Celluloid. The cutting out is done preferably by machine, [illegible], circular and band saws, and cutting wheels with straight and fluted edges. A wheel of special form is employed to cut out pairs of interlocking combs, which are finished on lathes and molding and other machines. Fine objects with curved [illegible] are cut out with [illegible]

[illegible] of celluloid [illegible]

Curving is effected by taking advantage of the plasticity which celluloid acquires on being gently heated. Celluloid hair pins, for example, are immersed in hot water, bent by hand on a metal form and then hardened by being plunged into cold water. These operations must be performed with skill and care, as celluloid becomes white and opaque when heated too strongly.

Celluloid objects of the utmost variety of form are produced by molding, in which operation the softening influence of heat is again utilized. The object, approximately shaped by other methods, is inserted between the two segments of a bronze mold, which are in contact with the heated plates of a steam press. When the celluloid has become sufficiently plastic, the plates are forced together, and the celluloid assumes the exact form of the mold, which it retains after cooling. Leaves, petals of flowers, and similar small thin objects of celluloid are shaped by stamping with dies.

The operation of blowing is performed on celluloid tubes as they are drawn from the press. A tube of suitable dimensions is placed in a heated mold composed of two or more segments and, when soft, is inflated by a blast of high pressure steam which forces the celluloid into contact with every part of the mold, which is cooled before opening. In this way whisk broom covers and similar cup-shaped objects, as well as dolls, animal figures and other toys are made The parts of celluloid boxes and other built-up objects are sometimes joined by means of acetone, acetic acid or other solvents of celluloid. Cheap boxes are varnished with a solution of celluloid in acetic acid, which saves polishing with pumice stone.

For decorating the surface of celluloid, aniline colors dissolved in alcohol are employed.

Air Resistance Experiments.

A useful critical comparison of the work of Frank and Eiffel is presented by W. Schule in the Zeitschrift des Vereines Deutsch Ing The law that resistance is proportionate to the square of the velocity has been verified by Frank for velocities up to 6 m./sec., and by Eiffel from 15 to 40 m./sec. The specific resistance is proportional to the normal area, and this resistance does not reach its maximum with an area of 1 sq. m (Eiffel). The results of Frank for right circular cylinders and cones of various angles are in contradiction to those of Eiffel The error is considered to be on the side of Eiffel, and further, the resistance deduced by the latter from his experiments with inclined plates requires substantial correction. The resistance of an inclined plate increases very quickly with the inclination of the plate up to 30 deg., and much more slowly thereafter. Frank's coefficient for the surface friction of plates moving parallel to their length, viz., 0.00344, shows that the resistance of such a plate is 236 times less than that for the same plate moving along the normal. This coefficient agrees well with the resistance coefficient of vapors and gases in motion through tubes. In the region from 10 deg. to 0 deg. plate inclination, the surface friction is of prime influence on the specific resistance. Employing Frank's law of friction along with Eiffel's results for plates inclined at 20 deg. to 30 deg., the air-resistance may be found for the region of most importance in flying technique, viz., between 0 deg. and 15 deg., at 5 deg. inclination, the resistance R, referred to the unit of surface projection, passes through a minimum value (k min. = 0.1 in the formula $R = k \times$ area $\times$ air density $\times$ velocity$^2/g$). Air-resistance is composed of three parts—the acceleration resistance, and friction, external and internal. Internal friction only becomes of importance for angles of 15 deg. inclination and less. The direction of the resultant thrust on a plane surface only begins to deviate from the normal for plate inclinations of 5 deg. and less; for 5 deg. the deviation is 4 deg. from the normal, and for 1 deg. it is 34 deg. The ratio of upthrust to moving force for an inclined plate in motion is greatest for an inclination of 5 deg., and the [illegible] upthrust reaches a maximum for the angle [illegible]

Celluloid watch crystals have [illegible] guaranteed not to break [illegible] celluloid crystals are [illegible] higher grades of watches [illegible] timepieces. Of [illegible] been employing these crystals [illegible] more than [illegible] durability.

The Home Laboratory

TELESCOPE LENSES AND HOW TO TEST THEM.

BY PROF. S. A. MITCHELL, COLUMBIA UNIVERSITY.

The arrival of Halley's comet and the interesting changes in its appearance noticed by the keen-eyed astronomer using a powerful telescope have naturally caused the uninitiated to inquire into the use of these glasses, and to wonder how much their eyes could see if a telescope were put at their disposal. Certain

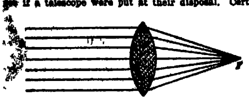


Fig 1.—FOCUS OF A LENS.

it is that the first look through a large telescope would be disappointing, for nothing appears as big or as magnified as expected. The beginner is apt to believe that he could see the whole moon at once and as if only a few miles away, but is amazed to find he can see only a small portion of it and that shimmering and dancing in a purple haze. He may admire the beauty of the color not knowing that this is caused by an imperfection of the telescope which cannot, unfortunately, be got rid of. Indeed, the moon presents a prettier picture in a three- or four-inch telescope than it does in anything bigger It is in the hope of explaining the simple things about a telescope that this article is written.

It is sometimes thought that a telescope is powerful because the rays of light pass through a large number of lenses placed at intervals down the tube This idea, like many another popular one, is entirely erroneous The telescope gets its power mainly from the objective which causes the rays of light coming from the object under observation to converge, and if not intercepted form an image

The action of a simple lens is easily understood. If parallel rays of light fall on the lens in the same direction as the axis of the lens they will (Fig 1) converge to a point *F*, called the principal focus, and similarly, rays from *F* will emerge as a parallel beam. *F* may be on either side of the lens, and it is imma-

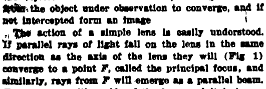


Fig. 2.—FORMATION OF AN INVERTED IMAGE.

terial in which direction the light goes through The distance from *F* to the lens is the focal length. Next, if we have a parallel beam not in the direction of the axis (Fig. 2). It will likewise converge to a point, different from *F* If we neglect the thickness of the lens, a ray through the center of the lens *C* will pass through undeviated, a ray *fa* through *f* the focus will emerge parallel to the axis. Rays from the north of the moon, *N*, will be brought to a focus at *n*, and from the south edge of the moon, *S*, to the point *s*. Hence the lens forms a real image at the focus, so that if we placed there a ground-glass or a photographic plate we would obtain a picture of the moon This image is inverted.

Three different ways of using the convergent pencil of rays from the object glass give three different kinds of telescopes. If the rays before they came to a focus fall upon a double concave lens we have the Galilean telescope, a principle which exists in the modern opera glass. This gives an erect image. If the image at the focus is examined with a double convex lens, a "magnifying glass," we have the astronomical telescope, first invented by Kepler. This gives an inverted image. If the image is examined by three double convex lenses, a compound microscope which again inverts the images, there results the terrestrial telescope, and objects are seen erect.

In the century following Galileo, telescopes were made of enormous length, frequently being over one hundred feet long, and one was made with a focal length as great as 600 feet. The older opticians had found that if they attempted to increase the size of the objective, it was necessary to still more increase the focal length if they were to obtain a clear field. The reasons are plain: rays falling on the middle of a simple lens are brought to a focus at a different point from those falling on the edge of the lens, as is shown in Fig. 3. The distance from *F* to *G* gives the amount of the "spherical aberration." Even more trouble was caused by the "chromatic aberration," the

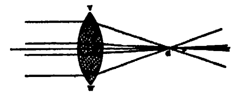


Fig. 3.—SPHERICAL ABERRATION.

star images had a great amount of color surrounding them. A lens may be regarded as a round prism Since a prism not only deviates light but breaks it up into the spectrum colors, a simple lens will act as is shown in Fig. 4, the violet light is most refracted and is brought to a focus at *v*, the less refrangible red comes to a focus at *R*, with rays of the other colors in between these two extremes. The result of all this is that if we focus for the yellow, the red and violet form rings around this and a star image is surrounded with a considerable amount of color Sir Isaac Newton was the first to explain these aberrations, and it is singular that although he made experiments to prove that glass and water disperse light differently, he did not forestall Dolland's discovery (150 years ago) of making an objective from a combination of two lenses, one a double convex lens of crown glass, the other a double concave lens of flint glass.

With such a combination the optician has four surfaces to figure, and as a result it is possible to almost entirely eliminate the spherical aberration, or in others words make a flat field But on the other hand it is still impossible to get entirely rid of color Flint

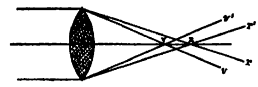


Fig 4 —CHROMATIC ABERRATION.

and crown glass do not disperse light alike, the flint relatively widens out the violet end the more The optician with glass of two different sorts at his disposal can bring two colors of the spectrum to a sharp focus For a visual telescope the rays generally taken are the yellow and the blue green Consequently both the red and the violet ends of the spectrum are not in sharp focus, and these form rings about the stellar image which combine to make purple color In small telescopes this color is not so pronounced, but with large telescopes of 24 inches or more aperture the color is conspicuous and cannot be got rid of This is known as the "secondary spectrum"

The problem of making a good visual lens is really a much simpler one than that of making a good photographic one. In the first place, in the ordinary telescope for visual purposes, the field is comparatively small, of only a few minutes of arc, and the process of making a field flat over the area is simple compared with that required in an instrument like the Bruce photographic telescope of the Yerkes Observatory, which photographs an area in the sky 16 deg square. With refracting telescopes the ratio of aperture to focal length is about in the ratio of 1 15 (the Yerkes 40-inch has a focal length of about 750 inches, a ratio of nearly 1 . 19). In a photographic telescope,

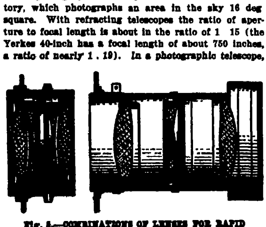


Fig. 5.—COMBINATIONS OF LENSES FOR RAPID PHOTOGRAPHIC WORK.

for the portrayal of a comet, for instance, as short exposures as possible are desired, and this calls for as great a ratio of aperture to focal length as possible. The ordinary amateur's camera works very well at a ratio of aperture to focal length of 1 16 If the lens is opened to 1 · 8 the photograph is not so sharp. Only lenses of the best makes can be used at 1 : 6. (Fig. 5.) Everyone who is familiar with the use of a camera knows how much sharper a picture is obtained by stopping down the lens. To obtain a flat field from a lens with an aperture of 1 5 is impossible with only two lenses; three or more are necessary Using glass of different indices of refraction which is possible from the fine qualities of Jena glass now procurable, separating the lenses properly and grinding their surfaces to the right curves, it is possible to obtain a flat field with an absence of color and astigmatism. (Fig 6.) The Bruce photographic telescope has an aperture of 10 inches with focus 50 inches It is a 4-lens combination, technically known as a "doublet."

Every skillful amateur knows how to test a photographic lens. This is perhaps done as well as any other way by the test cards for astigmatism, to see

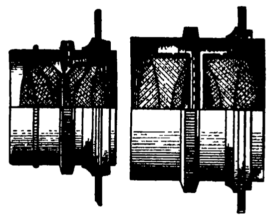


Fig 6 —COMBINATIONS OF LENSES FOR FLAT FIELD AND ABSENCE OF COLOR.

if straight lines which intersect at right angles become lines or blurred images at the edge of the field. Still a lens might answer all the requirements for ordinary camera work but be a poor astronomical lens. A camera might cut clear to the edge of the plate on ordinary work, but when a three or four-hour exposure is given on stars all imperfections will show up Unfortunately, for obtaining astronomical photographs a telescope mounting with a good driving clock is indispensable—which is usually out of the reach of most amateurs

On the other hand there are a number of small visual telescopes in the hands of amateurs, and a few words might be said in regard to testing them This is best done on a moderately bright star Focus carefully on it Push the eyepiece in slowly and note the change in appearance If the spot of light does not remain circular, the objective is not "squared on" properly, or the objective may be pinched in its cell This must be adjusted before anything more is done Now pushing the eyepiece in, the colors should

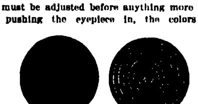


Fig 7 —WORK OF A RECTILINEAR LENS COMPARED WITH AN ANASTIGMAT BLURRING DUE TO ASTIGMATISM IN RECTILINEAR LENS.

change gradually and symmetrically as the disk of light enlarges The same should hold true by pulling the eyepiece outside the focus If the telescope behaves well from this test, turn to a double star like Castor As the amateur becomes familiar with the heavens, he will soon learn test objects for his telescope, and if he possesses a good instrument there is no keener pleasure than trying it night after night and becoming familiar with the beauties of the heavens.

POWDER PLATING OF METALS.

Before a meeting of the Royal Society of Arts, in London last January, a paper was read on an improved method of electro-plating It described the process of plating metals by rubbing them with a moistened powder, and a number of articles were plated with gold silver and zinc before the society. The new plating powders are not to be confused with plating preparations which have been in use heretofore and which act merely to exchange the surface metal of the article to be plated with a thin film of deposited metal. In the new process a truly electrolytic action takes place which results in the deposit of metal without taking away the surface metal from the object to be coated Furthermore the deposit may be made as thick as desired by continued applications of the powder The inventor of this plating powder began his experiments a number of years ago with a view to developing a process by which knives forks spoons and the like can be plated as readily as they can be cleaned with polishing powders, and he succeeded in devising a method by which almost any

metal and even certain alloys such as brass in various proportions of copper and zinc can be applied to metal objects. So far the new powders are not on the market in this country, but in England they are sold in small cans for a shilling each and one can is sufficient to plate the nickeled portions of a bicycle or to plate a quantity of household silverware.

The powders are composed (1) of the metal to be deposited in its elementary state, (2) of a salt preferably a salt of ammonia and (3) of a powdered metal which must be electropositive to the metal which is to be deposited. Magnesium is the most electropositive metal which it is commercially practical to use and in many of the preparations this forms the active metal element. In some of the preparations aluminium and zinc are used. The following formula gives the zinc plating powder:

Zinc	15 parts by weight
Ammonium sulphate	5 parts by weight
Magnesium	1 part by weight
Chalk	10 parts by weight
Soapstone	25 parts by weight

Ordinary commercial zinc dust, even though it is not perfectly pure, may be used. This same formula may be used for several other metals. If silver be substituted for the zinc in this formula a very heavy deposit will be obtained which will have the white frosted appearance of silver electroplating before burnishing. If gold is substituted for the zinc the deposit will be a light yellow, but various shades down to a rich red have been obtained by varying the formula. The article which is to be plated with the powder does not have to be cleaned before the powder is applied, for the powder itself acts as a cleaning powder and liberates the oxygen of an oxidized surface. The amateur who wishes to experiment with these powders should bear in mind that they have been patented abroad and that patents are pending in this country.

MAKING MILK ARTIFICIALLY

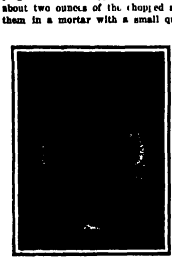
BY A. J. JARMAN

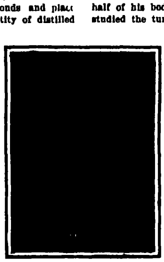
We have heard so much about the synthetic production of perfumes, syrups, dyes and what not from coal tar products, that we are not easily surprised by the information that milk may be artificially made. The method described below, however, is not a chemical one, but consists merely in the mechanical admixture of distilled water with crushed and finely ground sweet almonds. Practically the only difference between cow's milk and that made of almonds is that cow's milk contains animal casein, while the artificial milk contains vegetable casein. The latter will produce a good supply of cream, and if allowed to stand some time will become sour. It may also be coagulated by the addition of vinegar or acetic acid. When combined with grape sugar it is capable of generating some extraordinary organic substances. The artificial milk may be used with tea and coffee in the same way that cow's milk is used.

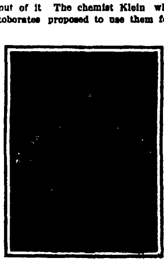
To make the milk procure half a pound of sweet almonds—the Valencia, which is cheaper than the Jordan almond, will give just as good results. The skin of the almonds may be removed by scalding the nuts in boiling water and peeling them with a sharp knife. The almonds should then be placed in a wooden chopping bowl and chopped as finely as possible. Take about two ounces of the chopped almonds and place them in a mortar with a small quantity of distilled water. Then grind or levigate the chopped almonds, adding water occasionally until about twelve ounces of water have been used. The longer the grinding is continued the thicker and richer will the milk be. Now take a piece of cheese cloth about 12 inches wide by 24 inches long and rinse it in clean water, and after wringing it as dry as possible fold it double over the top of a pitcher and pour the contents of the mortar through the cloth into the pitcher. The milk may be squeezed through the cloth by wringing it gently as shown in one of the illustrations, but care should be taken to prevent any of the larger almond particles from being forced through the meshes of the cloth.

If some of the milk thus produced is set aside for three or four hours a thick layer of cream will be found on the surface. If too much water has been used in forming the milk it may be necessary to add a little sugar of milk to sweeten it. The artificial milk has a slight almond flavor when taken clear, but this is practically lost when it is used with tea, coffee or cocoa. The color of the cream produced is quite pale, but it may be improved by using some of the almonds without the skins removed in the proportion of two ounces of whole almonds to six ounces of the blanched almonds. Care must be taken to prevent any bitter almonds from finding their way into the mixture, but one or two bitter almonds to half a pound would not affect the flavor of the milk.

Half a pound of almonds will make three pints of milk.







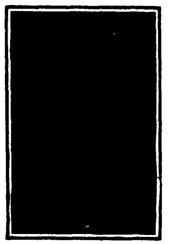
Chopping the almonds. Grinding the almonds in water. Filtering the almond milk.

MAKING MILK ARTIFICIALLY

SOME EXTRAORDINARY DENSITIES

BY H. F. GUSTAVE [illegible], STATE COLLEGE

Pick up any common heavy stone such as granite or compact limestone. Lay it at the bottom of a vessel filled with a fluid transparent liquid. Common sense tells you that the stone will stay there. Modern



A COMMON HEAVY STONE FLOATING IN A GLASSFUL OF BROMOFORM

chemistry tells us that if the liquid has been selected for such a purpose the stone will spring up to the surface as if it had been forced into mercury instead of being immersed in what seems to be water.

Liquids which are denser than glass, marble or common stones are not numerous. Leaving aside the metals mercury and gallium and the metalloid bromine, which is opaque, caustic and emits suffocating vapors, the most interesting of such liquids are the aqueous solutions of the tungstoborates. Their densities reach 3.3 (saturated solution of cadmium tungstoborate). An idea of the meaning of such a number can be gathered from the fact that a man with his shoes weighted so as to lower his center of gravity could stand erect in such a solution with more than half of his body out of it. The chemist Klein, who studied the tungstoborates, proposed to use them for the sorting of ores and other minerals, as in most cases useful or precious stones only will go to the bottom of their solutions. Their price, however (the saturated solution of cadmium tungstoborate is sold at two cents a gramme), will for some time to come preclude such an application.

Solid aluminium remains on the surface of such liquids. To see a metal floating over a watery fluid is, however, no new spectacle for the chemist, several of the [illegible] metals being lighter than water. The cheapest of these [illegible] is sodium. This experiment should not be made with a piece larger than a [illegible], for it is sometimes attended with unexpected explosions and projections of caustic soda. As a rule, however, the metal runs swiftly and quietly over the water while decomposing it.

Sodium is the cheapest of the extremely light metals, but it is not the lightest. Lithium, a beautiful metal of a silvery white color, is lighter than dry pine wood. Yet, from the chemical standpoint, it is more metallic in its properties than the heavy osmium, which occupies the other extreme position in the list of solid elements arranged according to their increasing densities.

Such extreme differences in density are not found among liquids, yet organic chemistry gives us two colorless transparent liquids which so differ that a vessel filled with the lighter of them, amyl hydride or pentane, and easily carried by one man, could not be lifted by four men when filled with bromoform. The density of pentane is 0.6, that of bromoform 2.9. Both liquids are apparently more fluid than water, and it is always amusing to watch the countenance of the unaware person who is requested to remove a glass full of bromoform from one place to another. Bromoform is sometimes prescribed by physicians against whooping cough. It is found at every drug store and costs but $1.75 a pound.

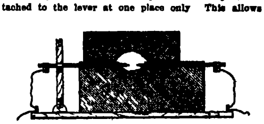
But it is with gases that the greatest divergences in density occur. Iodoform vapor, which causes the intense stench of that well known antiseptic, is 197 times heavier than hydrogen. When some iodoform is vaporized in a porcelain dish placed over an alcohol or gas lamp it is partially decomposed. Iodine vapor is set free and remains mixed with iodoform vapor. As iodine vapor is itself one of the heaviest of gases the experiment remains very beautiful. If the air is quiet a lateral jerk given to the dish causes the layer of violet gas to oscillate heavily just as a liquid would do in similar circumstances.

A SMALL ELECTRIC FURNACE

BY A. E. PARKINS

The accompanying cut shows the cross section of a small electric furnace made from a description of the Moissan furnace. In this one the brick and lime cavity are replaced by a block of limestone about 5 x 5 x 9 inches. In the top face of the base is hewn a cavity about 1 x 1 x 2 inches, also two longitudinal grooves to receive the carbon electrodes.

The cover is a similar stone with a cavity hewn in its lower face. Both base and cover should be bound with a piece of sheet iron or tin to keep the pieces in place should the heat be great enough to crack the stones. The carbons are regulated by means of the vertical lever hinged at the base and attached to the carbon by means of a clamp. This clamp is attached to the lever at one place only. This allows



A SMALL ELECTRIC FURNACE

sufficient horizontal movement. The electrodes are connected to a lantern circuit (alternating current 212 volts) by means of clamps. These clamps and other metal work are made from sheet aluminium—easy to cut and easy to shape. The bolts used are short stove bolts.

In such a contrivance calcium carbide, calcium phosphate, phosphorus, brass and alloys are easily prepared.

Calcium carbide requires intense heat; the cavity should be small. Gas carbon or powdered arc light carbon is best to use.

Calcium phosphide is prepared by heating calcium oxide, carbon and red phosphorus. The phosphorus is placed in first in small quantities; this is covered by the other ingredients well mixed and pulverized. Some kinds of animal charcoal and calcium oxide will produce calcium phosphide.

Phosphorus is prepared as directed in Newell by heating a phosphate, charcoal and sand. Phosphorus is separated and burns at the top. It sometimes sublimes on the faces of the stones and bursts into flame when the cover is lifted. The glass like slag remains in the furnace. This is exceedingly hot. Pieces of porcelain are easily melted when pushed into this plastic mass.

Brass is easily made by heating zinc and copper. The stones may be obtained from the refuse heap of a stone cutter's. The corner of an old [illegible] good instrument for cutting the [illegible] School Science and Mathematics.

NEW BOOKS, ETC.

SCIENTIFIC AMERICAN HAND BOOK OF TRAVEL. With Hints for the Ocean Voyage, for European Tours, and a Practical Guide to London and Paris. Compiled and Edited by Albert A. Hopkins, Editor of the SCIENTIFIC AMERICAN Reference Book. New York: Munn & Co., Inc., 1910 18mo.; 400 pp.; 500 illustrations. Price, $2 net in flexible cloth; full leather, $2.50 net.

There are no conditions of travel in which a few general hints as to how to adjust one's affairs can prove so useful as on a sea voyage, and it is with the object of preparing the traveler for his trip by telling him how to go, how much it will cost, how to amuse himself, and what to do when arriving at the coveted shore, that this book has been written. It is the result of twenty years' investigation and travel on the part of the Editor, who is a member of the staff of the SCIENTIFIC AMERICAN. The work contains six color plates and an elaborate set of maps in a pocket in the back of the book, including an excellent showing map of Europe published by the Automobile Club of America. The maps of London and Paris are on a new plan The illustrations were selected from over 5,000 which were placed at the disposal of the Editor, and many of the scenes on shipboard have never before been reproduced. The book is of a convenient size to be carried in the pocket and is a handsome piece of book making. The writer gives the kind of information which he himself and others of his acquaintance have wanted to know on various transatlantic voyages. Much of the material presented is in so readable a form that pages can be read by the score, which is something unusual in a guide book or similar book of reference. Thus it tells how the circuit of the earth can be made in thirty-eight days, instead of the proverbial eighty days of Jules Verne, it tells how it is possible to leave New York Wednesday morning and reach London Monday night and Paris Tuesday morning. The book is so extensive that it is impossible to do more than call attention to a few of the salient features. The question of time is admirably dealt with, and the elucidation of the twenty four-hour clocks used in Berlin, Italy, and Spain is of particular value. The traveler's vocabulary in four languages precludes the necessity of the purchase of special books on the subject, as does also the cable code. The question of expenses is dealt with in detail, while the much vexed question of baggage is considered at some length. Various ocean fares are given, as well as information as to how to carry money The sizes of foreign coins are given by means of diagrams, which will prevent much confusion in the minds of those who use foreign coins for the first time The list of articles not to be forgotten is one of the interesting features of the book The section relating to telegraphs and cables is absolutely complete, and is indorsed by the officials of all the leading telegraph and cable companies. "The Voyage" is dealt with in detail from the time of coming on board until the landing on the foreign shore. The smallest thing which can help, interest, or amuse the traveler will be found in the proper place; thus, for the concerts there is given "America," "Star-Spangled Banner," "God Save the King," "Rule Britannia," "Marseillaise," and the "Watch on the Rhine," which are all of the national anthems of four countries that are usually played. The question of seasickness is the subject of some three pages, and the best and most successful remedies are given The technical portion relating to the ship deals with everything from the keel to the lookout, and is accompanied by interesting engravings, many of which were made specially for the book. The section on "Ocean and Navigation" deals with the work of the officers and describes the many interesting things which are met with, such as icebergs, whales, etc, and the amount of nautical lore conveyed is considerable. Everything relating to signals is presented. The section relative to statistical information offered peculiar difficulties which have been surmounted in a masterly manner. Thus the list of transatlantic passenger steamers is given which sail not only from New York, but from such minor ports as Galveston. There are maps of all the harbors in the United States from which steamers arrive and depart for both Europe and Asia. The railroads of the world, distances in nautical miles between ports and lights are also given. The section devoted to "The Arrival" is a highly important one, dealing with all of the principal terminal ports and ports of call. The book even tells the visitor how to get to Hoboken. The section relating to "Railways" gives much-needed information which cannot be obtained elsewhere in the English language. The part of the book devoted to Tours occupies thirty-[illegible] pages, and gives 400 tours with prices. There is also a list of 2,000 hotels and their rates, and a most valuable chapter on automobiling in Europe, which has been unquestionably indorsed by the leading automobile clubs and associations. The Guide to London was written by the English correspondent of the SCIENTIFIC AMERICAN, Mr. F. A. A. Talbot, who is well known to our readers, and is without exception the [illegible] guide to the [illegible]. The practical guide [illegible] who are not thinking of taking a European trip will find the book of the utmost value as a work of reference.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC VENTILATOR.—W. MEHLHORN, Charlottenburg, Germany. The invention relates to a ventilator consisting of an electromotor and two fans, one of which is fastened on the armature shaft of the electromotor, while the other fan is mounted on a suspended support to turn around a vertical axis and is adapted to carry within its bell-shaped nave the casing of the electromotor

TRICK ELECTRIC POCKET LAMP.—A JANEL, New York, N Y More particularly this invention relates to that type of apparatus in which a movable part may be unexpectedly released during the handling or manipulating of the device One object is to construct the device so that it will have the exact appearance of a pocket electric light with the battery casing, light bulb and switch or push button

Of Interest to Farmers.

ADJUSTABLE COMB FOR GRAIN-STRIPPING MACHINES.—E. A A PAVY, North Parade, Jamestown, South Australia, Australia. The comb is for use with strippers and stripper harvesting machines in which the adjustment is made by increasing or decreasing the width of the individual teeth The purpose of the inventor is to enable the comb to be quickly adjusted to take a heavy or a light crop and also to enable a choke to be easily and quickly cleared.

BALE-TIE MACHINE.—J A. SCHARF, Richwood, Ohio. An object of this improvement is to form a machine which will perform the various operations of drawing out, bending, twisting, stretching, cutting and removing the bale-ties from the machine, with a small amount of power and with the least attention from the operator

Of General Interest.

ABDOMINAL RETRACTOR.—J E SPARKS, Crossett, Ark. The invention pertains more especially to abdominal retractors, although with suitable modifications the instrument may present a speculum for the parts, a rectal speculum or mouth gag, in any case, the feature of adjustment and automatic locking of the spreading arms being substantially the same.

GOPHER-TRAP.—A. F. RENKEN, Kramer, Neb. This invention refers to means for killing the pocket gopher, a type of field rat that closes the mouth of its burrow with earth that it pushes in front after a burrow is extended and widened sufficiently to permit the animal to turn around. This trap is adapted to kill this rodent by taking advantage of its peculiar habits.

Heating and Lighting.

COMBINED GAS AND ELECTRIC FIXTURE.—A. I SCHWINGER, New York, N Y This fixture is in the form of a highly ornamental chain, having a continuous channel for the passage of the gas and an interrupted passage for the electric wires, to permit of conveniently threading the electric wires in the links of the chain and to give access to the wires at any time for repairs or other purposes.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

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Lathes gear cutting attachment for, J M Campbell 955,498
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Propeller wheel, A. B. Seltzer ..... [illegible]
Propulsion of vessels, F W Schroeder ..... [illegible]
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Valve inserting machine, C. A. Hoefer . . . 955,334
Vehicle body, B. R. Bailey . . . 955,494
Vehicle, motor, Messler & Bollstrom . . . 955,602
Vehicle propelling means, motor, J. R. Faber . . . 955,146
Vehicle wheel, J. W. Halladay . . . 955,440
Vehicles, pneumatic spring suspension for, O. A. Rhoads . . . 955,692
Vehicles, removable storm cab for, W. A. Hunter . . . 955,404
Vending machine, perfume, A. F. Norre . . . 955,723
Ventilating device for use in connection with windows, A. W. Martin . . . 955,178
Vessel, marine, B. Settergren . . . 955,708
Vessels, apparatus for raising sunken, B. P. Clark . . . 955,762
Vessels, device for raising submarine, M. A. Laubeuf . . . 955,414
Vise, adjustable, G. A. Geffert . . . 955,290
Vulcanizer, C. A. Shaler . . . 955,479
Vulcanizer removable cover, A. Adamson . . . 955,739
Wall covering, P. C. N. Pedersen . . . 955,420
Walls, apparatus for the construction of plastic, H. G. Babel . . . 955,304
Warp handling apparatus, H. D. Colman . . . 955,383
Washer. See Securing washer.
Washing machine, Maxwell & Hymer . . . 955,181
Washing machine drive gearing, F. Kostian . . . 955,412
Watches, stem winding and setting mechanism for, G. Kern . . . 955,336
Water closet valve, G. W. Fleming . . . 955,790
Water controlling device, E. P. Gaylord . . . 955,150
Water elevator, J. L. Wray . . . 955,701
Water meter, J. H. Connell . . . 955,766
Water motor, H. T. Farnsworth . . . 955,148
Water motor, G. W. Codfield . . . 955,601
Water or other fluid heating apparatus, G. A. Fowler . . . 955,395
Water wheel, W. E. Seelye . . . 955,479
Water wheel governor, W. D. White . . . 955,568
Water wheels, gate controlling mechanism for, W. W. White . . . 955,569
Wood burning appliance, G. L. O'Neale . . . 955,420
Weighing machines, electrical controlling mechanism for, H. Richardson . . . 955,693
Well digging apparatus, M. Latta . . . 955,817
Well drilling machine, W. C. Stevens . . . 955,012
Wheel rim securing means, O. E. Schornrock . . . 955,213
Wheel support, vehicle, O. H. Givens . . . 955,790
Whip lock, J. Erickson . . . 955,588
Whip lock and robe fastener, L. L. Noakes . . . 955,530
Whip socket lock, J. R. Schwears . . . 955,701
Wind motor, A. W. Bailey . . . 955,300
Winding machines, stopping mechanism for yarn, H. C. Miller . . . 955,657
Windmill, A. T. Scott . . . 955,290
Windmill, A. M. Cox . . . 955,764
Window lock, R. R. Reynolds . . . 955,476
Windows tight against the ingress and egress of air, device for making, H. Higgin . . . 955,157
Wire chain, L. A. Brown . . . 955,120
Wire cutter, A. B. Schofield . . . 955,287
Wire, treating rods for, Remmen & Roeigl . . . 955,552
Wood, preserving, W. B. Chisholm . . . 955,762
Wood shaping machines, safety device for, J. M. Jones . . . 955,408
Wrench, I. H. Flory . . . 955,781
Wringer base for laundry tubs, P. J. Madden . . . 955,341

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

SCIENTIFIC AMERICAN

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The great length, 521 feet 6 inches, of the ship made it necessary to build the ram bow above one of the navy yard streets and railroad tracks, upon a special steel-and timber bridge as shown above. The launching weight of the huge ship is 9,000 tons; at sea she will weigh 21,825 tons.

Photograph by E. Mueller

THE "FLORIDA" READY FOR LAUNCHING AT THE BROOKLYN NAVY YARD.—[See page 374.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, MAY 7th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE AEROPLANE AND THE DIRIGIBLE

In all the history of mechanical achievement it would be difficult to find a parallel to the combination of intelligence and audacity with which a few men in as few years, have lifted the art of flying from the dreamland of the impractical enthusiast into the world of brilliant accomplishment. It was not so very long since that a scientist of world-wide reputation attempted to prove that because of certain fundamental principles the art of flight by means of heavier-than-air machines was not commercially practicable. Nevertheless within a period of considerably less than a year, more than one aviator has flown at a speed of over forty-seven miles an hour, another has covered a distance of 144 miles in a continuous flight of four and a quarter hours, a third has flown across the English Channel, and a fourth, Paulhan, the most distinguished aviator of them all, has soared nearly a mile into the air and finally has surpassed even that feat by flying from London to Manchester, covering a distance of 186 miles, with but one stop for fuel, at an average speed of over forty miles an hour.

The significance of this really wonderful race between Paulhan, the Frenchman, and White, the Englishman, is apparent only when we consider some of the details which have been cabled to this side of the Atlantic. That Paulhan should have won the $50,000 prize in such superb style at the very first trial is a tribute both to his own skill in manipulation and to the excellence of the Farman biplane with which the race was won, but to appreciate the full significance of the race, we must remember that both contestants, and particularly White, flew for a considerable stretch of the journey at night time and, what is of even more importance, that they did not hesitate to make both the ascent and the descent in the darkness. No stronger evidence than this could be afforded that the aeroplane is an instrument of precision which can be relied upon to answer with certainty to the controlling hand of the operator.

There is something strongly suggestive of bird flight in the description of the manner in which one of the contestants after leaving the ground swept through the air in a wide circle in order to get the lay of the land and the proper direction of flight, or to pick up again a course from which he had been driven by the wind. But certainly the most difficult feat of all was that of making a landing at night time in a locality with which the aviator was quite unacquainted and where he had to make a wide detour looking for a suitable stretch of unobstructed surface on which to alight.

Last year in commenting upon the status of the art of flying we pointed out that the one last obstacle to be overcome before flight could be reckoned among the practical achievements was that of successful starting and alighting upon the average surface which would be encountered in cross-country flying and performing these feats with certainty in a breeze of ordinary strength. The London-to-Manchester race would certainly seem to prove that this important stage in the development of human flight has been reached and successfully passed.

In strong contrast to these achievements of the aeroplane is the series of disasters to airships, culminating in the wrecking of the huge dirigible "Zeppelin II," which have occurred during the last few weeks. Although the dirigible has proved to be perfectly stable and to possess the ability to fight its way against winds of considerable strength, the late disasters and notably the wrecking of the "Zeppelin," emphasize the fact that, whenever these huge and delicate fabrics approach, or are in contact with, the ground, they are in imminent danger of destruction. In this respect, they are in the same class as the ocean steamship, whose captain cares little what winds may blow, when once he is well clear of the land with everywhere deep water below his keel, but whose anxieties increase in proportion as the water shoals, and the vessel again approaches the coast line.

The peril of the dirigible lies in its huge bulk and the great area which it exposes to the pressure of the wind. These elements, it is true, are not a source of so much danger when once the craft is well clear of the earth and has abundance of what the navigator would call "sea room" in which to maneuver, but when it comes to the question of making a landing, and so long as the airship is upon the surface of the ground in an unprotected position, as she must needs frequently be, the dangers of disablement and even of complete disaster are ever present. We all remember how the accumulated pressure of the wind on the French airship "Patrie" tore it loose from the soldiers who were frantically endeavoring to hold it down to earth and carried it over the English Channel and across Ireland to be lost in the ocean beyond. So too in this later disaster, the "Zeppelin," during an enforced landing, was caught in an increasing wind in which it was only a question of time before the pressure proved too strong for the company of infantry that was endeavoring to hold the airship in place.

Wind pressure on large structures runs up to enormous figures. The designers of bridges make provision for a maximum pressure of thirty pounds on every square foot of surface. If we apply this unit of pressure to the "Zeppelin" we find that on a plane surface represented by the total length of 446 feet and the diameter of about 40 feet, plus the area of the cars, rudders, etc., the pressure would amount to about 250 tons, and if we admit that the effective pressure due to the circular shape of the gas bag would be only about one-half of this, there would still be a strain of 125 tons upon the guy ropes, etc., by which the machine was held in position.

If we include the Lake Constance disasters, this is the third or fourth wrecking of a Zeppelin dirigible by its being dashed to pieces in stormy weather after making a landing, and the moral is that these ships of the air should remain as far as possible permanently afloat, tying up when they wish to make a stop, to lofty steel mooring towers, which they must approach end on, and to which they must make fast by cables from the bow. This we believe, is the plan which Zeppelin himself proposes to follow, and it would certainly seem to be the only arrangement that offers security against absolute shipwreck.

THE DECLINE OF THE UNIVERSITY IN SCIENTIFIC RESEARCH

So many valuable discoveries and researches are now due to scientific institutions under government control or founded and supported by private munificence for specific purposes that the question arises: Is it not to such agencies rather than to the universities and colleges that we must look for the most active progress in future original scientific investigation?

Not only are these institutions for special research freed from the duty and cares of teaching, but what is of greater importance, their organization and equipment are generally far more efficient. Every possible assistance is rendered to the individual investigator, and he in turn is carefully selected for his proficiency and promise, and with ample facilities at his disposal and supplied with an adequate salary, he is expected to work systematically along certain definite lines with entire freedom from financial or administrative concern.

At the head of these institutions there are usually directors who are men not only of eminence in their special science but competent to organize and conduct campaigns of scientific research, which may include a number of workers often in widely different fields, yet all engaged in studies merging into one definite scheme. Each worker receives full credit for his particular contribution, and the solution of great and complex problems is undertaken with all the efficiency of organization and co-operation characteristic of the best and most modern industrial and commercial practice. Yet there is no sacrifice of the true scientific spirit and the only elements of the commercial world that are applied are economy of effort and resource, efficiency of organization, and adequate capital and plant to push to a satisfactory outcome any particular project or class of investigation.

These conditions have attracted many investigators of reputation, and in such scientific establishments as the various laboratories of the Carnegie Institution of Washington, the Rockefeller Institute for Medical Research, and the research laboratories of manufacturers' associations and large corporations, not to mention those conducted [illegible] auspices, much scientific work [illegible] is done. One might refer to [illegible] for the study of tuberculosis [illegible] diseases, to national physical [illegible] and bureaus of weights and [illegible], to astronomical observatories and biological [illegible] museums and meteorological observatories. In nearly every case there would be found an interesting record of scientific activity. This work is of [illegible] original character and is often important both to science and in its application to the everyday affairs of humanity.

With this ever increasing efficiency on the part of special research institutions, we are brought face to face with the fact that no longer are American colleges and universities with their various scientific schools and laboratories in as good a position to forward scientific research as of old. In a few cases there are special endowments which support observatories, laboratories or clinics where there is but slight interference from governing boards and administrations, but, speaking generally, the American university is not always able to supply the material facilities for modern research, nor is its organization such as to make its prosecution possible under conditions of economic efficiency. For so extended is the work of the great American university that its departments cover at least in theory, an inconceivably wide range of knowledge and subjects, and for their support appropriations none too large must be granted by administrations and governing boards without any exact and special knowledge of their comparative needs or the merits of their work. Where even the lay trustees of a special institution can pass understandingly on the plans, projects and budgets of such an organization, with its well defined field, the governors of a university, overwhelmed by the intricacy of the situation as well as by its magnitude, usually adopt a policy of averaging their appropriations to different departments rather than of assuming the responsibility of passing on the merits or urgency of their work.

But important as are material support and facilities to modern research, this is by no means the only or most serious question, for the man of genius triumphs eventually over the difficulties due to their absence. So extended have American universities recently become, both in scope and number of students, that members of their faculties are compelled not merely to give an unduly large amount of instruction along lines once considered fundamental, but in addition to offer courses in special or allied branches involving no small amount of painstaking preparation. So keen is the competition on the intellectual side, and in the number of courses offered and in the desire for large registration, that an executive head of the university demands from his staff, as a condition of salary advance or promotion, the greatest possible amount of teaching, be it congenial or not. Under such conditions it is not difficult to see that the time and inclination for special investigation and research by a young scientist occupying a university chair may be seriously curtailed. Furthermore, so intricate is modern university mechanism and even minor administration that from a professor there is required an ever-increasing amount of clerical labor in the compiling of statistical and other records, and information about students and departmental activities, according to the exactions of the educational machinery, which to-day is apt to imitate commercial forms rather than commercial efficiency and economy of effort. Thus in the misunderstanding of the professor's function and misuse of his time, a partial explanation may be found for the relatively poor showing that American professors of science make in comparison with their European colleagues. This condition, university presidents and trustees in America tell us, can be remedied by the provision of great and further endowments for research chairs and laboratories, but it now seems an open question whether such funds are not more productive when applied to special institutions apart from educational machinery. It must not be understood that the training of young men for scientific research has experienced any slackening of effort in our universities and technical schools, for it is these men stimulated as never before by their professors, who will bear forward the torch of scientific progress. Education and original discovery seem destined in the future to be carried on by totally distinct organizations.

That the silver area in northern Ontario is continually being widened is evidenced by the discovery of native metal about fifty miles west of Cochrane on the Grand Trunk Pacific. It is understood that the discovery was made in blasting out a railway cut. When the news reached Cochrane, sixty prospectors started out the next morning and this number is being constantly augmented by fresh arrivals.

AERONAUTICS.

Mr. A. L. Pfitzner has been making successful flights with his novel monoplane (which was illustrated in our issue of February 12th) of late in various places On April 15th he made three successful short flights at the Buffalo Country Club, and in the fourth flight he ran across the field at a high rate of speed, rising to a height of ten or twelve feet, when a gust of wind struck the machine and drove it to the ground with great force. The aviator was bruised and badly shaken up, and his machine was more or less seriously damaged. Despite his accident, Mr Pfitzner has demonstrated that his novel sliding wing tips work well

Messrs. A. M. Herring and W S Burgess have been experimenting with the former's new biplane on Plum Island, opposite Newburyport, Mass. This new machine, which was illustrated in our issue of March 19th, has demonstrated that it can slide over the ground and rise from its single skid without the use of wheels. On April 17th, Mr Herring made a short flight of about 250 yards On the 21st he made three other flights, in the longest of which he covered about 300 yards at a height of fifteen feet The next day Mr. Greeley S Curtis, while flying the machine at an estimated height of thirty feet, lost control of it The biplane descended and struck the ground head on, fortunately in a soft meadow It was badly smashed, but the aviator was not injured

While aviation advances by leaps and bounds, aerostation has had several serious setbacks of late To begin with, on April 3rd the German balloon "Pommern," celebrated for having won the Bennett cup race in America in 1908, fell into the Baltic Sea and three of its four occupants—one, Herr Delbrück, a member of the Reichstag—were drowned The next day Prof Abegg, a well-known German chemist, was killed while making a landing, while on the 18th ultimo the balloon "Delitzsch" carrying four men burst during a thunder storm while at a height of several thousand feet, all its occupants being killed by the fall. It was at first supposed that the balloon was struck by lightning, but this was afterward found not to be the case Emperor William, however, has had a thorough investigation made and is getting together all the facts regarding the igniting of the gas in balloons by atmospheric electricity

As far as dirigible balloons are concerned, Germany, which for some time past has been in the lead with this form of air craft, has also suffered severely After making various cruises in the vicinity of Cologne, the "Zeppelin II" "Gross II," and "Parseval I" airships flew from that city to Homburg on April 22nd and were reviewed by Emperor William As a gale sprang up, the airships were moored at Homburg over night. As strong winds continued, the "Gross II" (which is a non rigid dirigible) was deflated and shipped back by rail. The "Parseval" and "Zeppelin II" attempted to make the return journey, but only the former was successful in accomplishing it. The "Zeppelin" lost gas and was forced to descend at Limburg, where it was moored again over night, and fully inflated in the morning At noon a sudden squall of wind tore the huge dirigible from its moorings and it floated off without a crew A half hour later it was driven to the ground at Weilburg It fell beside a cliff and broke in two The sudden demolishment of this, the principal airship of the German fleet, has shown how precarious is the existence of these leviathans of the air

On April 21st Prof John J Montgomery, of Santa Clara College, Santa Clara, Cal, lectured before the Aeronautical Society in New York upon his aeroplane experiments. These were begun in 1883, and Prof Montgomery met with no little success from the start After first trying a flapping-wing machine, he next built a monoplane glider having wings 10 by 4½ feet in size, and patterned after the wings of a gull, i e, with a downward curve in front. Upon running down hill with this first glider, he rose and glided 600 yards He steered and maintained equilibrium by leaning his body to one side or the other He next endeavored to secure better control, and to this end studied the birds closely He was able to determine just how they warp their wings. Then he built several machines with warpable wings resembling a fly's wing in structure He made scientific experiments upon the lifting power of curved surfaces; and he finally evolved a Langley-type warpable glider having curved surfaces and a *fixed vertical* tail (in conjunction with a movable horizontal tail) that worked splendidly, and that could be steered simply by warping the wings. This machine, piloted by Daniel Maloney, was cut loose from a balloon at heights of 1,000 to 3,000 feet, and the aviator was able to pick a landing place and alight wherever he pleased. Prof Montgomery secured a U. S. patent (No. 831,173) on September 18th, 1906, and in view of his practical demonstration of steering *without the use of a vertical rudder*, it would seem that this rudder is not as essential as the Wright brothers claim.

ELECTRICITY

The Subway Telephone Construction Company of Chicago has promised to provide that city with a complete automatic telephone system by the first of June next year At first it will cover only the business district, but later will be extended to the residential sections

Merchants in the South have awakened to the value of rural telephone lines, and are seeking to develop them, with a view to increasing their trade among the rural population In certain sections they have made large contributions to aid the farmers in building their lines

The Weather Bureau has arranged to give daily weather forecasts by telephone to farmers in Texas At noon each day rural subscribers are called up, and the weather forecast is announced to all simultaneously Subscribers in towns and cities can obtain the weather forecast at any time of the day after 11 A. M by calling up central

A writer in Physikalische Zeitschrift has been investigating the frequency of electrical oscillations when a condenser is discharged through a spark gap He finds that this depends to a large extent on the nature of the electrodes. For instance, a discharge between copper and silver electrodes would give a longer wave length than a spark between magnesium electrodes, and he comes to the conclusion that magnesium is the most suitable metal for spark electrodes

A new system of jointing lead cables has been developed in England It consists in placing a thin ribbon of pure tin between the surfaces that are to be joined, and then heating them with a blow lamp. The surfaces in the presence of the tin melt at a lower temperature than normal, and thus they are soldered together The tin ribbon is treated with a composition to prevent oxidation during heating Another system of jointing consists in the application of a mold over the cable A piece of tin ribbon is applied to the surfaces which are to be joined, and then molten lead is poured into the mold The flow is so directed as not to burn through the lead sheathing of the cable

The fourteen-year-old president of the Junior Wireless Club of America appeared before the Senate Committee on Commerce last week to protest against the bill introduced by Senator Depew for regulating wireless telegraphy The young president gave a very forcible argument in favor of amateur wireless telegraph operators, pointing out the fact that if the bill were passed it would check the inventive genius of some forty thousand experimenters He also called attention to the fact that it would be impossible to enforce the bill without a veritable army of expert wireless telegraph engineers The junior wireless telegraphers claim that it is possible to cut out interference if the proper apparatus is used, and that the present attack on amateur wireless telegraphers is unwarranted

The Third Avenue Railroad Company of New York tried out last winter a gasoline-electric car on its crosstown lines. Now another type of car is being tried, and a comparison will be made of the two The new car is a reconstructed horse car provided with Gould storage batteries and a pair of five horse-power motors The battery is placed under the seats of the car and has a rating of 420 ampere-hours at 84 volts It is made up of twenty-nine plates per cell, and there are forty-four cells at each side of the car The gases that are generated by the battery are carried off by a ventilating system and exhaust under the rear platform The car weighs only six tons fully loaded It has been found to consume in actual service only 0 54 watt hour per ton mile, while maintaining a speed of six miles per hour with nine stops per mile

The steel hull of a vessel is rendered magnetic during construction by the hammering of the metal, and every steel vessel has to have its compass corrected to counteract its own magnetic lines of force The magnetic influence is further complicated by the load carried by the vessel if this load is magnetic or capable of being magnetized The ore-carrying vessels of the Great Lakes experience great difficulty on this account, and the United States Hydrographic Bureau is endeavoring to teach pilots and captains of vessels plying in this trade how to check their course by means of the pelorus The pelorus is an instrument similar to the sun dial, being provided with a gnomon and a graduated arc on which a shadow of the gnomon is cast. The instrument is set in a north and south direction, as indicated by the compass, and then by noting the shadow on the graduated arc, it is possible to tell by comparison with tables, furnished by the government, just how far from the north and south position the gnomon really lies, thus showing the compass error

SCIENCE.

Prof. Adams, of the Mount Wilson Observatory, has been making a spectroscopic study of Halley's comet He finds the head to be surrounded by cyanogen gas and the tail be to composed of hydrocarbons

Sir Ernest Shackelton received a gold medal from the Geographical Society of Philadelphia at a dinner given in his honor on April 22nd Among those who spoke in praise of Sir Ernest's achievements were such famous Arctic explorers as Rear Admiral George Melville and Amos S Bonsal

In an article published in Light Mr Robert E Livingston states that the first man to use gas in New York city was Mr Samuel Legget who lighted his house at No 7 Cherry Street with it The people kept at a respectful distance from the house, fearing an explosion Newport Rhode Island, and Baltimore Md, soon followed New York

Rev. George M. Zwack, S. J., secretary of the Philippine Weather Bureau has prepared at the request of the insular government a paper on 'The Return of Halley's Comet and Popular Apprehensions' for distribution throughout the islands with the object of reassuring the natives, who, it is said, are already a prey to many wild rumors on this subject

The American Philosophical Society of Philadelphia has decided to assist in the movement for an expedition for south pole exploration The project was urged in 1909, when the following scientific societies united in an appeal to Congress The American Academy of Arts and Sciences American Geographical Society California Academy of Sciences, New York Academy of Sciences, Franklin Institute, Geographical Society of Philadelphia, American Museum of Natural Sciences, Geological Society of America Association of American Geographers and the American Alpine Club

In a lecture delivered before the Royal Society of Naples Prof A Piutti called attention to the discovery by Palmieri in 1881 of a characteristic line of helium in the flame spectrum obtained by heating in a flame 'an amorphous, buttery substance of a yellow color which was found as a sublimate on the edge of a fumarole near the mouth of Vesuvius' This is generally accepted as the first discovery of terrestrial helium, although Nasini and Andelini in 1906, on examining the flame spectrum of a large number of volcanic incrustations failed to recognize the presence of helium in any of the specimens they examined under the condition described by Palmieri

The Express of London claims that another word must be added to the dictionary of gardening This is 'Caloriculture the name of an entirely new system of horticulture which has recently been inaugurated, and bids fair not only to replace the form of intensive culture of the French school, but to revolutionize the present system of fruit and vegetable forcing While it is nearly customary to look for extreme and favorable developments in the line of soil cultivation, through French means, to us in the United States, who have not the garden habit quite so strongly as obtains in France it comes as a surprise that the inventor of the new method is a Briton Dr F Alexander Barton, Fellow of the Royal Society

For the last year systematic excavations have been made at Ostia, the ancient harbor of Rome at the mouth of the Tiber The ruins of a large city built probably by Hadrian over the old republican town, have been uncovered Archæologists consider the discoveries as important as those of Pompeii Heretofore it has been believed that Ostia was founded by Ancus Martius the fourth King of Rome that it was destroyed by Marius during the civil wars rebuilt during the republic sank into insignificance, and was buried in the sand and deposited in the Tiber when Trajan built the new port and city of Portus Instead of this it is now certain that Ostia not only continued to flourish under Hadrian but that the old level was raised six feet and that the republican town served as the foundation for a model city with rectangular wide streets, temples fora and squares

A case of extraordinary if not unprecedented horizontal temperature gradient is reported on apparently trustworthy authority in the Meteorologische Zeitschrift for March 1910 With a temperature ranging between 0 deg and +2 deg C at Helsingfors Finland on November 18th, 1909 a temperature of 20 deg to 24 deg C was simultaneously recorded at a point only 10 kilometers distant to the north, a difference of about 20 deg C (68 deg F) in a distance of about 6 miles While the climate at Helsingfors is tempered by the Gulf of Finland so remarkable a difference between the temperature there and in the immediate hinterland is inexplicable especially as the two stations at which observations were made are of the same altitude The strangest part of the story, however remains to be told viz., that a little to the north of the place where the low temperature was reported the weather was almost as warm as in Helsingfors'

THE NICE AVIATION MEET

WITH DETAILS OF THE CROSS-COUNTRY RACE FOR THE LONDON DAILY MAIL'S $50,000 PRIZE

One of the principal aviating meetings which has been held abroad this year was that at Nice from April 15th to 25th Two of our illustrations show Farman biplanes that participated in this meeting The one in flight over the sea was piloted by Duray, an old time automobile racing driver, while the one which is shown on the beach was piloted by George Chavez Chavez on the 17th ultimo accomplished several long flights above the sea In one of these the fuel gave out and the machine landed on the beach, as shown The meet opened under auspicious weather conditions and some splendid flights were made on the opening day At one time in the afternoon four biplanes and a Blériot monoplane were all in the air at the same time Effimoff Chavez and Van den Born, all of whom flew Farman biplanes made some excellent flights Rougier also made brilliant flights, on one occasion crossing the Var, and another time flying half a mile out to sea Metrot flew for half an hour on his Voisin biplane, and Olieslagers made several short flights in his Blériot monoplane which appeared to interest the spectators more than the biplanes on account of its bird like appearance The English entrants in this meet, Messrs Rawlinson and Rolls, were unfortunate The first named was unable to fly more than half way around the track the first day on account of trouble with his Darracq motor which he was using on his Henry Farman biplane while Mr Rolls did not receive his Wright biplane from England

The second day of the meet nearly all the aviators made excellent flights. Herr Grade s monoplane failed to arrive and so he did not participate in the flights. Effimoff made a flight of 80¾ miles, and Van den Born flew 40 miles Mr Rawlinson made a daring flight out to sea While turning above the water, he was approached too closely by Effimoff, the result being that although the two aeroplanes did not touch each other, Mr Rawlinson's fell into the sea, and was badly damaged The Russian aviator was fined for faulty driving.

The results of the first day's flights in the various contests were as follows

Total Distance Prize—Effimoff (Farman biplane), 130 716 kilometers (81 17 miles) Chavez (Farman biplane), 105 508 kilometers (65 52 miles). Van den Born (Farman biplane), 87 508 kilometers (54 34 miles) Metrot (Voisin biplane), 15 kilometers (9.31 miles)

This competition was for the total distances flown in all flights made during the day by each competitor

Starting Prize, Without Passenger.—Effimoff (Farman biplane), 80 meters (262 4 feet).

Starting Prize, With Passenger—Effimoff, with Prince Koudacheff (175½ pounds), 100 meters (328 feet)

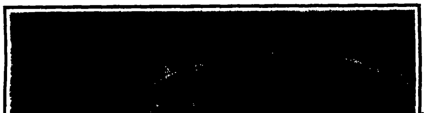
Prize for fastest circuit of the course, $400. Won by Effimoff, who flew 6 kilometers (3.73 miles) in 6 minutes 23 3/5 seconds—a rate of 35 miles an hour

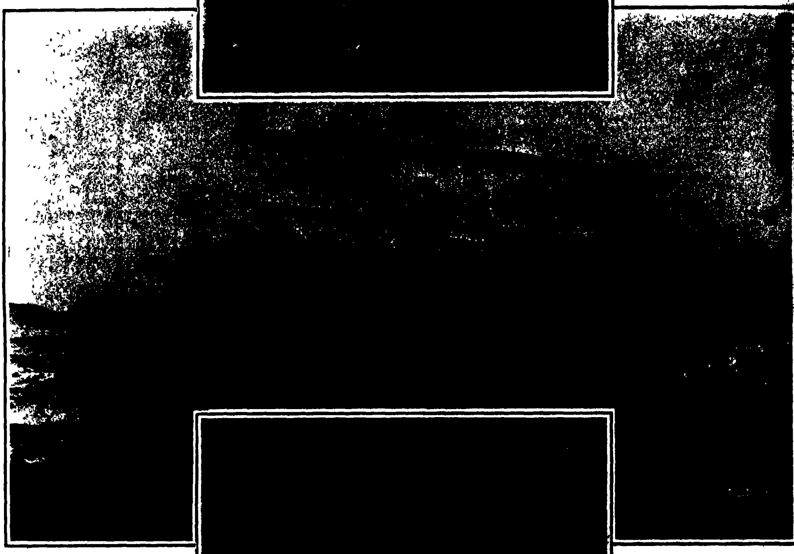
In this aviation meet over a dozen aviators competed, and many other flights were made.

The greatest sporting event that aviation has had thus far, as well as the chief demonstration of the practicability of the aeroplane for the rapid transportation of individuals, was the race from London to Manchester, England, on the 27th and 28th ultimo, for the prize of $50,000 offered three years ago by the London Daily Mail. On April 23rd Mr. Claude Grahame White, an Englishman, attempted the flight on his Farman biplane. After covering the 115 miles to Litchfield in 3 hours and 6 minutes, he quit battling with the violent wind and the cold The next day his aeroplane was badly damaged by the wind while in its temporary shelter. It was taken apart and shipped back to London for repairs. Meanwhile aviator Louis Paulhan visited London and entered the race His Farman biplane arrived from France on April 27th, and after working hard all day at London, he got it assembled and started aloft at 5 21 P M., flying immediately to Hampstead (5 miles from London) and crossing the starting line at 5 31 He had a map tied to his waist, and he followed a special train on the railway 1,000 feet below

Soon after Paulhan started, word was brought to White, who had completed the repairs to his machine and who was resting at his hotel Rushing in an automobile to his aeroplane, he started at 6 32 from Wormwood Scrubbs in pursuit of Paulhan But the latter had gained an hour's flying time before darkness settled down, and he alighted at Litchfield at 8·10 just as the 14 gallons of gasoline he carried were entirely consumed. White alighted at Roade, near Northampton, after a flight of 1 hour and 23 minutes in which he covered 60 miles. He started again at 2.54 A. M. and succeeded in getting within about 15 miles of Litchfield before Paulhan again resumed his journey. He flew over Weedon, Crick, and Rugby in the darkness, and alighted at Polesworth, nearly 100 miles from London, after an hour's flight. Late in the afternoon he flew 10 to 12 miles farther, but the race practically ended for him at Polesworth The conditions required the flight to be made within 24 hours and with not more than two stops en route. Paulhan

(Concluded on page 391.)





1. Chavez's wrecked Farman machine which dropped into the water when his fuel gave out. 2. Duray flying over the breakers in his Farman biplane. 3. A novel hydro-aeroplane fitted with a three-cylinder Anzani motor.

THE AVIATION MEET AT NICE.

PECULIAR SPIRAL ARCH OF THE ESKIMO SNOW HOUSE.

BY A. L. KROEBER, CURATOR OF ANTHROPOLOGY UNIVERSITY OF CALIFORNIA

There is a type of dome that can be built without a scaffolding and that requires a man to be immured within the vault to insure proper construction. It is the invention and sole property of that most ingenious of savage races, the Eskimo and contains several principles new to civilized architecture

There are four fundamental types of arch and dome, of which one is the Eskimo peculiarity The simplest and least used, because least effective is of the simple lean-to type—illustrated by and to-day chiefly employed for, the house of cards Next comes the false inverted-step arch where each block or brick projects beyond the one below and is held from toppling in by the weight of the material above and behind it This type of gateway and chamber was invented independently by the architects of Agamemnon more than 3,000 years ago in ancient Greece and the precursors of the Aztecs in Mexico at nearly as early a period This construction inherently demands a vast amount of backing or fill in proportion to the vault of the arch It is feasible for a gate in a long wall, or for an underground hall or drain but cannot stand alone and is a *false arch* A free portal, or a dome rising into the air cannot be built on this principle which is consequently but little employed to-day Our true arch embodies the third method its essential feature being the use of wedge-shaped blocks When the last and central one of these pieces—the key stone—is dropped into place the whole mass supports itself The top cannot fall inward unless the supports are toppled outward The primary thrust is therefore always not in but out and buttressing of some sort is requisite Another inherent defect of this arch though we are so accustomed to it that we do not usually note the fact is that until the key stone is fitted into final position a temporary structure must be erected to hold up the parts already in place The last type the Eskimo vault is a true dome exerts no outward thrust and requires no temporary scaffolding It is also unique in that its material is not brick or stone but *snow*

The construction is used for the beehive-shaped winter houses of these so-called savages and is spiral in plan as shown by the diagrams A row of blocks is first laid on the ground in a circle—or more exactly a polygon. Each of these has a slightly slant top and each thus raises its surface a little beyond the last until when the circle is completed the gap in height between the last and first blocks gives the thickness for the following courses In these the upper and lower surfaces of each block are parallel as in a brick but the gradual upward trend given by the first course is of necessity maintained

In each successive round the snow bricks are leaned inward more by having their lower surfaces sliced off to a bevel If set squarely end to end they would before long lean inward so far that they would tumble For this reason the end of the block last laid is cut at an angle. The next following block has the joining end slanted at the reverse angle Thus it fits in behind the preceding and is prevented by it from slipping inward As the house grows the circles become smaller until at last only an irregular polygonal opening is left This is filled with a wedge-shaped block cut to shape It is however not a key stone as the remainder of the structure supports itself

The blocks of firm snow are usually dressed outside and handed for placing to the man on the inside The last block he holds up with one hand slices to shape with his ivory knife in the other, and drops into position He is then entirely inclosed in the vault. Only after the house itself is entirely completed does he cut out the low door, which to keep out the cold as much as possible is only big enough to crawl through A long low tunnel is then built in front of the door, to break the force of the Arctic's icy blasts Even a window is present A small aperture is cut out over the door and filled with a pane of clear thin ice All that is omitted is the flue or chimney Whatever heat is produced by the seal-oil lamps is wanted inside, warmth being a more serious necessity in the climate than ventilation or freedom from smoke.

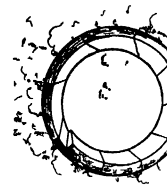
Whether the type is practicable in other materials has been doubted The unsurpassed lightness of snow is certainly a great advantage In heavier materials strength would, however, compensate for increased stress of gravity, and good mortar should make up for the inward slipping tendency that weightier materials would show

The greatest difficulty in working in stone would be encountered in shaping the separate pieces of masonry Owing to the spiral and leaning construction no two blocks can be exactly alike in either shape or size and in every succeeding course each block departs more and more from the right angle in its proportions To compute in advance exactly the proper angles for each piece so as to insure true joints would be a matter of much complex mathematical calculation

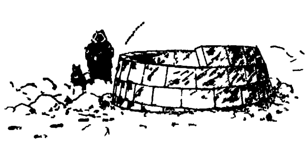
It might however be practicable once the calculations had been determined for a building of standard size to draw up a table of the angles and dimensions required for each successive block If the size of the structure were reduced or increased from the standard each stone would only require to be diminished or enlarged by a fixed ratio

It would take our ablest engineers longer to plan such a dome than an Eskimo would need to build a village but the resulting simplicity of construction due to the inevitableness and simplicity of the progress of erection without any temporary supports buttresses or reinforcement might more than compensate

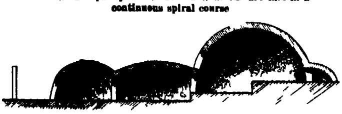
The spirally ascending bevel locking Eskimo dome is the only true vault any part or the whole of which will stand entirely by itself



Plan view of partly built hut, showing how each block supports the next.



Eskimo hut partly built. The snow blocks are laid in a continuous spiral course



Section through Eskimo snow house

THE PECULIAR SPIRAL ARCH OF THE ESKIMO SNOW HOUSE

A GASOLINE MOTOR DRIVEN EARTH-BORING MACHINE

BY WALTER LAN FORD

The details of construction and method of operation of a unique gasoline motor-driven earth boring machine are shown in the accompanying illustration The device was recently designed in California by Charles I Belly and the photograph represents it in working position in actual operation at Sacramento and near Selma Cal

It is stated that with one of these machines about 25 miles of holes were bored for use in fencing along the right-of-way of the Western Pacific Railroad between Marysville and Oroville Cal These holes were bored under particularly trying conditions as the ground was gumbo land with the exception of a short stretch of marsh soil and so hard and so dry that every bit of it had to be broken with pick and crowbar when dug by hand Part of it in addition to the hard ground had about 20 to 25 per cent small cobble yet this labor saving device bored through all of it and did the work of from twelve to fifteen men

Such a machine is of great value for boring holes for posts for numerous other uses for which shallow holes are required and for the purpose of lightening the labors of man Experience shows that the harder the ground and the more difficult it is to work the more earnestly a machine of this class is desired

This entirely new unique and practical engine driven apparatus is a most remarkable device in its simplicity and owing to its wide range of use as a labor saver it stands unsurpassed It will be seen that it is extremely simple easily operated and entirely practical and will be found a great economizer of time and money where post holes are to be dug electric line telegraph or telephone poles set or where trees and vines are to be planted in holes uniform in size at top and bottom and of suitable diameter and depth

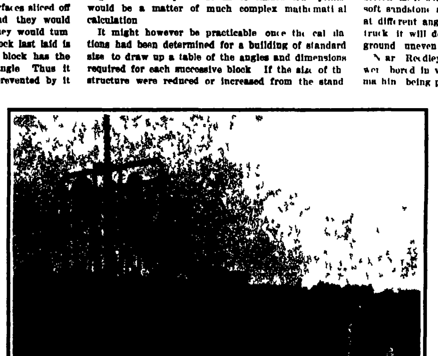
It is held to be practical for use everywhere as by test the machine will work satisfactorily in either dry or wet soil or in any place where the machine can be driven as it bores readily through hardpan and shale soft sandstone and small cobble and as it will bore at different angles and on either side or back of the truck it will do equally good work whether on level ground uneven ground or hillside

Near Reedley Cal a great number of holes were bored in very hard hardpan for large poles the machine being particularly successful in this work because the contrast between its efficiency and hand labor was so strongly marked At Mendota Cal a record was made by one of these machines on large fence work in hard dry earth 90 holes being bored 22 feet apart and 30 inches deep in 60 consecutive minutes the holes being 8 inches in diameter

For use in boring small holes a vertical engine of the double cylinder type is utilized that develops 7½ horse power In boring holes for large poles a machine of this type is fitted with an 18 inch auger effecting a depth of 6¼ feet The power is supplied in this case by a double cylinder gas line engine of 12 horse-power capacity

This device is said to be inexpensive to operate as a man and a boy only are required for its efficient working the boy to drive the team and the man to manage the machine Its net earning capacity is said to be greater than that of a threshing machine costing five times as much Its season of usefulness extends over the entire year and in many instances in hard ground has done the work of fifteen men

It is maintained that in cold countries where other farm work



WORKING POSITION OF EARTH-BORING MACHINE READY TO BORE A HOLE.

is impractical during the severe season, post holes can be dug and fences built during the winter, as this machine is well adapted to boring through ice, frozen ground, hardpan, shale and the like

In the planting of orange trees peach trees, grape vines or in having a piece of land underlaid with hard pan in which holes for any purpose are expensive to dig this form of machine will do the work of making an opening through any crust for the top root of the tree

The upper frame and boring tower being on a rotatable platform, one can easily adjust the machine to a hole on either side or at the rear of the machine When the device is in a position to bore a hole, all that it is necessary to do is to pull the feed clutch, and the auger drops to the ground and begins work, when the auger is loaded, by releasing the feed clutch and pulling the hoist clutch in, the auger is hoisted clear of the ground, or to any other position that may be desired

It is of interest to note that besides boring in the kinds of soil before mentioned the machine will bore in dry clay, or in swamp land without any change of augers or bits no ground being too sticky for it to work There is no necessity of stopping the machine to clean mud off the auger as the machine does that itself

If there is an occasion to bore a line of holes down the middle of a well traveled road it will do the work without difficulty A small type of earth boring machine has been designed which will bore to a depth of 4 feet and which is equipped with two augers 8 and 12 inches in diameter, while a larger machine has been developed which will hole to a depth of 6 feet The latter is fitted with three augers 8, 12, and 16 inches in diameter

It is stated that no change of shaft or auger is required to make the depth indicated The time required to move from one hole to another and begin work in a fence line is from 15 to 25 seconds

The feed pinion of the machine as well as the feed rack, drill shaft gearing, and auger shaft are made of crucible and machinery steel so as to withstand a sudden impact as when stopped by running against rocks, old posts and similar obstacles

Chain belting is used of the standard sprocket type and in case of a break can be easily replaced It will be seen that this machine in boring does not scrape the earth but cuts it with chisel bits, which are quickly detachable the entire set being changed in two minutes if desired

It is reported that this machine has bored many holes 30 inches deep in hard ground in fifteen seconds for each hole from the time the auger touches the ground, and it is hard ground indeed when the hole cannot be bored in a minute It has force feed, and therefore all the attendant has to do is to pull the lever and the machine does the work

LAUNCH OF THE "FLORIDA."

On the morning of Thursday, May 12th, there will be launched at the Brooklyn Navy Yard the second of the two largest battleships yet built in the United States the "Florida" The sister ship, the "Utah," which in December last took the water at Camden N J from the building slips of the New York Shipbuilding Company, weighed about eight thousand tons The launching weight of the "Florida" will be about nine thousand tons, which is, in itself a record for an event of this character The keel of the "Florida" was laid on March 9th of last year, and the work of construction has been carried on uninterruptedly under the supervision of Naval Constructor William J Baxter with Naval Constructor William G Groesbeck immediately in charge

In view of the great importance of the ship, and the gratifying rapidity with which she has been built, preparations have been made to render the ceremony of launching particularly brilliant Among the guests on the launching platforms will be President Taft, Secretary George Von L Meyer, Assistant Secretary Beekman Winthrop Albert W Gilchrist Governor of Florida with his staff, Admiral Dewey, and Rear Admirals Evans Sperry Schroeder, Wainwright, Potter and Luetze As the battleship fleet is now present at the yard between six and seven thousand bluejackets and the officers of the ships will assist in giving dignity to the event In agreement with the custom of having our ships christened by a representative of the State or city after which they are named, the ceremony will be performed by Miss Elizabeth Fleming of Jacksonville Fla

The naval constructors and employes of the Brooklyn Navy Yard are to be congratulated on having, for the second time demonstrated that they are capable of building the largest and most modern warships, not only with dispatch but of the most thorough and durable workmanship, for it will be called to mind that from these very ways there was launched on September 29th 1904 the flagship "Connecticut," which, although a much smaller ship than the "Florida" (less by about 6,000 tons, in fact) was nevertheless the largest vessel of her time in the United States navy, and approximately as large as any vessel in the navies of the world. It is a long step, however, from a 16,000-ton "Connecticut" to a 21 825-ton "Florida," and the Brooklyn Navy Yard should receive full credit for the fact, that while eighteen and a half months elapsed from the laying of the keel to the launching of the "Connecticut," it has taken only fourteen months to do the same amount of work on the big ship The material has been built into the hull at an average rate of about twenty-five tons per working day of eight hours If all goes well, the hull and accessories will be completed early next spring. The date of the completion of the machinery is somewhat uncertain, the recent reorganization of the navy yard having thrown the steam engineering shops somewhat out of their stride

The greater length of the "Florida," which exceeds the "Connecticut" by over sixty five feet, her greater beam of eleven feet four and a half inches, and her increased launching weight of many thousand tons necessitated, of course, a great enlargement and strengthening of the permanent and launching ways, and severely taxed the capacity of the building slip Our front page illustration shows how the ram of the ship extends entirely across one of the streets of the yard and abuts against the wall of a building

In spite of this fact, the stern of the vessel reaches almost to the bulkhead wall on the water front

Just here it is well to notice how, in order to secure the desired speed of 20 75 knots, the lines of the ship have been fined out, as compared with former battleships The entrance of the "Florida" appears to be as fine as that of our armored cruisers At the same time in order to secure good lifting power forward, when the ship is driving into head seas, above the water line the sections are flared out very rapidly, thus giving the ship a form which is not only buoyant and seaworthy, but adds greatly to the appearance of the vessel

The "ways" consist of the permanent ways made up of the supporting piling, cross caps and longitudinal timbers and the launching ways, in which she immediately rests, built to conform to the underwater form of the ship, which travel with her as she moves down into the water The heavy longitudinal timbers, which form the sliding surfaces between the fixed and launching ways, are thoroughly lubricated with a special preparation, consisting chiefly of tallow, lard oil and graphite The contact surfaces are made sufficiently broad to bring down the maximum pressure on the ways to 2 3 tons on each square foot The ship is released and started on her swift slide into the water by sawing through the "sole beams," which are the last members that connect the launching ways with the permanent ways The "Florida" will move very slowly at first but gather way rapidly, and her highest velocity will be about twenty miles an hour

With the launching of the "Florida," the United States navy will have afloat its first complete division of ships of the dreadnought type consisting of the "Delaware," "North Dakota," "Utah," and "Florida." A study of the accompanying table shows that the

COMPARISON OF THE "NORTH DAKOTA" 1908, AND THE "FLORIDA," 1910.

	"North Dakota"	"Florida."
Length	518 feet 9 inches.	521 feet 6 inches.
Beam	85 feet 2½ inches.	88 feet 2½ inches
Draft, mean	26 feet 11 inches *	28 feet 6 inches.†
Displacement	20,000 tons.	21,825 tons.
Coal supply	2,500 tons	2,500 tons.
Oil	400 tons.	400 tons.
Belt armor	12 inches to 8 inches	10 inches to 8 inches
Turret armor	12 inches.	12 inches.
Battery armor	6 inches	6½ inches.
Smokestack protection	6 inches.	9½ inches.
Twelve inch guns	Ten	Ten
Five inch guns.	Fourteen	Sixteen
Speed contract	21 knots.	20.75 knots.

* With two-thirds full supply ammunition and stores

† With two-thirds full supply stores and fuel and full supply ammunition

"Florida" is an enlarged "North Dakota," having the same length between perpendiculars, and two or three feet greater length over all, three inches more beam; one foot seven inches more draft, and 1,825 tons greater displacement She is designed to have three thousand more horse-power, but a quarter of a knot less speed The armament in each case consists of ten 45-caliber 12-inch guns mounted in five turrets on the center line of the ship The 12-inch pieces for the later ships in the case of the "Wyoming" class will be more powerful, being fifty calibers in length with a correspondingly greater muzzle velocity and energy In the broadside, torpedo-repelling battery, the "Florida" has two more 5-inch guns than the "North Dakota."

It is claimed by our Navy Department that the "Florida" and her sister are the best-protected warships afloat special attention having been given in her design to guarding the vital parts of the ship against mortal injury and to the localizing of the destructive effects of projectiles and torpedoes. Against sinking by torpedo attack the "Florida" is safeguarded by an elaborate sub-division of the hull and an unusually powerful pumping plant for ridding the ship of such water as may enter Against gun fire she presents probably a more complete system of armor protection than any contemporaneous warship. The main armor belt, over eight feet wide, has an average thickness of eleven inches, above this is another eight-foot belt averaging nine inches thick, while the five-inch broadside battery on the main deck and the bases of the smokestack carry heavier armor than has been placed on any previous United States ship, the front wall of armor being 6½ inches, while back of the guns runs a wall of 3-inch armor To reach the bases of the smokestacks a shell would have to pass through 9½ inches—an unprecedented but, as the Japanese war showed, a necessary protection Between each pair of 5-inch guns is a 2-inch transverse, splinter bulkhead.

The "Florida" will be driven by an equipment of Parsons turbines, working on four shafts. They are required by contract to develop 28,000 horse-power, which, it is estimated, will enable the ship to maintain an average speed of 20 75 knots on trial As a matter of fact, she is likely to do from three-quarters to a knot better than this. The "Florida" will store, in addition to 2 500 tons of coal, some 400 tons of oil fuel. Our naval constructors have long recognized the value of oil as an auxiliary fuel, and as far back as 1907, when the plans of the "North Dakota" and "Delaware" were drawn, provision was made for storage of oil, the ships of that class carrying 400 tons.

The keel of the "Utah," built by contract with a private yard, was laid on March 15th, and the keel of the "Florida" on March 7th The "Utah" was launched on December 23rd, 1909, at the 50 per cent stage of completion, and the "Florida" on May 12th will take the water with 68 per cent of the work completed, a comparison which establishes once more the much-contested claim of the Brooklyn Navy Yard that it can build as rapidly as the private yards.

The Lubricating Value of Mineral Lubricants at High Temperatures.

The behavior of a mineral lubricant at very high temperatures is dependent upon its chemical and physical properties upon the nature of the atmosphere with which it is in contact—dry air carbon dioxide, or water vapor—and upon the pressure of this atmosphere Schreiber in a recent article describes his investigations of the lubricating value of mineral lubricants of very high melting points, in various conditions The diminution of the lubricating power at high temperatures is due to the evaporation of a portion of the lubricant and to the formation, by oxidation, of compounds of the nature of asphalt, i. e., compounds insoluble in benzine It is not due to polymerization, as is generally believed This increase in asphaltic matters is not produced in the presence of water vapor alone, even at a pressure as high as 7½ atmospheres. In this case the diminution of the lubricating power is due solely to the evaporation of part of the lubricant. On the other hand, when the lubricant is in contact with a gas which can exert an oxidizing action, compressed air, for example, the formation of these insoluble compounds is the chief cause of deterioration Schreiber deduces from these experiments laboratory methods of measuring the lubricating power at high temperatures, according to the class of machine in which the lubricant is to be used

The Current Supplement.

The current SUPPLEMENT, No 1792, contains an unusual number of interesting illustrated articles Mr Harold Holcroft contributes a splendid paper full of practical suggestions and helpful ideas on the principles of vitreous enameling of cast iron for industrial purposes Mr Henry A Wise Wood's excellent review of modern stereotypy methods is continued Rear Admiral R H S Bacon critically considers the armorclad, and points out what type of vessel is likely to be evolved from it in the future The North African region lying in Algeria and Tunis affords almost an unlimited field for archæological research. Some recent discoveries in this country are described in an illustrated article by the Paris Correspondent of the SCIENTIFIC AMERICAN It is very difficult to recognize stars by studying the star maps and then seeking the stars marked on the maps Mr F R Russell, in an article entitled "Where to Find the Stars," provides the necessary link between the star maps and the sky A table of aeroplanes at Olympia is published, with some observations on the theories of flight. The food supply of the future is considered by H B Armsby

La Lumière Electrique publishes a series of articles reviewing the effects of the great Paris flood in January, 1910, upon the electric stations, telegraph, telephone, and electric light service of Paris and its suburbs. The St Denis establishment escaped inundation owing to its judicious arrangement of pumps and sluices and its elevation above the ground, and continued in operation without any interruption. Most of the other plants were less fortunate. Even the new underground wireless telegraph station at the Champ de Mars was submerged for several days, and its delicate apparatus was very seriously injured.

Correspondence.

WHY WATCH SPRINGS BREAK.

To the Editor of the SCIENTIFIC AMERICAN

It was with an amateur's interest that I read the discussion in your pages as to "Why watch springs break." As the question apparently still remains unsettled, I feel tempted to contribute some additional views on the subject.

Formerly clock springs were finished very rough, giving the convolutions considerable frictional grip upon each other For this reason, when running down, there was a very audible shuffling sound within the clock every few minutes, indicating the propelling force was spasmodic. Not only so, but the ticking sound of the escapement decreased in loudness as the time was prolonged from the last loosening of the coil. To regulate this it occurred to me to apply a more unctuous lubricant to the spring to prevent the said friction. The result of so doing was a gratifying uniformity of tick—but only for a few hours—until the spring broke

After the third experience of this kind I ceased to regard it as a mere coincidence, and thereafter applied no oil if there was sufficient to prevent rusting already on the steel.

The uncoiling of a watch spring and of the kind of clock spring that has just been described differs in that the watch spring unwinds from the outside of the coil, while the clock spring arbor backs up and unwinds from the center of the coil For this reason the latter is not subjected to a breaking from contraction due to cold, as there is always some room for the contraction to take place—excepting a possible momentary period just after winding The same is not the case with a watch spring.

If over-lubrication is destructive to the structure of steel in a clock spring, by rendering all the convolutions continually active and under unremitting strain, the same would also apply to a watch spring Watch springs being smaller than those intended for clocks are naturally proportionally stronger and may endure the strain longer, but that it is detrimental is probable. But oil on a watch spring is absolutely necessary solely to provide for this thermostatic movement which can only take place back and forth, to and from a fixed point—the arbor Yet the wearying strain on a spring due to over-lubrication can only be a contributory cause to the prevalent breaking of this part. Experience goes to show that the most frequent time for breakage is from an hour to three hours after winding, and that the most frequent position of fracture is just outside of the annealed tip attached to the arbor

Thus the owner takes his watch from his pocket where its temperature was, say 80 deg, and winds it until it brings up hard The coil is then central and solid upon its arbor, which is held fast by a pawl and ratchet

In a little while the wearer of the vest containing the watch removes it, hanging it on the back of a chair while he retires for the night The temperature of the watch gradually falls to say 60 deg Has contraction been provided for? The morning will disclose. If the coil has not been wound too tightly on, if some time has elapsed before cooling to enable it to draw on what has been paid out, or even if the rate of cooling and consequent contraction has not exceeded the rate of release due to the movement of the works, the spring may escape But what surprised the writer is not the breakages but the length of service many springs attain

When one considers that the greatest movement of contraction is on the outside of the coil, because of its greater area, that the coil has just been rendered taut and rigid by winding, and that then a powerful contracting force is added thereto, principally on the outside of the circle where the leverage is greatest, it is not difficult to realize what an unendurable strain takes place close to the fulcrum, the arbor, for the spring is then but a solid lever

The fracture of a spring in many places is also not hard to understand, if we imagine a spring stretched to its elastic limit by contraction from cold with no slack to draw upon, each turn of the spring, from the outside inward, at an ever-increasing tension An inner turn snaps, instantly contracts, and by that process increases the spreading or expanding trend of its temper. The change is altogether too rapid to permit of any uncoiling movement, and the force thus added to the adjacent surrounding strand fractures that, gathering force with each succeeding fracture until, like a "Prince Rupert's drop," the pent-up strain comes to rest with explosive suddenness.

That the pieces display magnetism does not necessarily indicate that it was produced from external influence, but rather that it was evolved by excessive strain and retained by the steel by virtue of its hardness, as is similarly evidenced by many machinists' tools subjected to severe service.

Regarding the preference of springs to break in the summer months, is it not sufficiently evident from the following three causes?

1 The more constant and wearying strain due to the better lubricating effect of warm oil.

2. The increased solidity of the coil when wound up, due to a thinner film of oil between the convolutions, also due to warmth

3 The looser texture and greater proportional shrinkage of a warm spring compared with a cool one

As to the remedy for this uncertainty of time-keepers, it would seem sufficient to provide for the longitudinal expansion and contraction of the springs, and the simplest way would be to make them of metal insensitive to these changes. Such an alloy has been described in SCIENTIFIC AMERICAN SUPPLEMENT, No 1714, by M Guillaume, which he calls "Invar" and is composed of steel with an admixture of 36 per cent nickel It is used for spiral springs, pendulums and graduated scales for instruments. The fact that it does not rust should complete its adaptability to this purpose, as then it could be used without lubricant and thus, except for a short portion at one time, be relieved of continuous and active strain

Just how the nickel component will affect its permanency of temper remains to be proven, but even if it retains sufficient recoiling force for its purpose for five years only, it would at least give warning of its waning strength and not leave its owner in the lurch, which is perhaps all the improvement needed

Another possible remedy which modern practice would indicate as quite feasible would be to carbonize the rods or plates, from which the springs are drawn, from one side only The result would be, when chilled, a hard side (for the inner side) and a soft or elastically tough side (for the outer side) with a general benefit of greater spring power with improved tensile strength

Watchmakers will tell you that the breaking of main springs saves many good watches from having their pivots cut off, from shear wear, and the views of the manufacturer need not be consulted but the ordinary citizen would prefer to have the spring as reliable as the rest of the watch JAMES E FRASER.

St. John N B

INTERESTING MAGIC SQUARE.

To the Editor of the SCIENTIFIC AMERICAN

In the December 11th issue of the SCIENTIFIC AMERICAN (page 436) Mr A Galpin gives an interesting construction of magic squares, containing all the odd

42	34	26	18	1	74	66	58	50
52	44	36	19	11	3	76	68	60
62	54	37	29	21	13	5	78	70
72	55	47	39	31	23	15	7	80
73	65	57	49	41	33	25	17	9
2	75	67	59	51	43	35	27	10
12	4	77	69	61	53	45	28	20
22	14	6	79	71	63	46	38	30
32	24	16	8	81	64	56	48	40

numbers in the inscribed diagonal square But this construction is applicable not only, as Mr Galpin says, when the basis is a prime number, but more generally when the basis is an odd number (1, 3, 5, 7, 9, 11,) The proof is very easy there is here the square of 9, as example of the simplest odd number not prime the general proof is an interesting exercise of algebra. DR. G VACCA

Genoa, Italy

HYDROGEN IN A HOT-WATER SYSTEM.

To the Editor of the SCIENTIFIC AMERICAN

A short time ago I noticed a phenomenon which I believe will be of interest to many of the readers of the SCIENTIFIC AMERICAN

The main building of our experiment station here is heated with hot water It has been one of my duties to see that the system is working properly, and in this connection I have had to open the air vents on the radiators frequently I was surprised to find that the radiators on the top floor (a two-story building) always seemed to have air in them, in spite of the fact that the system was fully charged and very little or no new water admitted I began to suspect that this condition had to be accounted for in some other way Was there not a possibility that this gas could be hydrogen? For what other gas would be likely to form under those conditions, unless it be a trace of carbon monoxide? At any rate, when I applied a match the gas lighted with the familiar pop of hydrogen and burned with its characteristic almost colorless flame Assuming that the gas is hydrogen (I have no means of testing it) the question suggests itself Is this a case of oxidation of the iron setting free hydrogen? Is it an electrolytic effect, caused by galvanic couples of either carbon and iron or iron and the brass connections in the system? Or is the gas methane? It may be noted further that the gas does not seem to collect in the radiators in the lower floor to a great extent, if any Of course, this may be due to the gas being dissolved under the increased static pressure The static pressure on the radiators of the top floor is not over ten feet of water at the present time The water is of exceptional purity, being supplied by a spring The fact, however that small quantities of water have to be added occasionally to replace the leaks in the system might suggest the presence of methane That question can only be settled by chemical analysis

Puyallup, Wash C WESTERGAARD

AN EARLY APPEARANCE OF ENCKE'S COMET

To the Editor of the SCIENTIFIC AMERICAN

The change which has come to the people in reference to comets is worthy of notice Seventy years ago when Encke's comet made its appearance a great deal of fear was aroused I was a young boy, but remember very well the alarm of the people It was indeed very strange and portentous, for it switched about from the zenith to the horizon, and was very brilliant *Its color varied from a light to a fiery red,* and its length was such that it stretched from the zenith to the horizon It hovered so long and was so conspicuous that all classes, young and old, were greatly impressed About that time the Millerite excitement prevailed, and there were many who looked upon the comet as a sure sign that the world was surely coming to an end There have been other comets which impressed the people but this exceeded all others in the impression made

Salem, Mass STEPHEN D PEET

A New Sense Organ of Butterflies.

Every butterfly collector has had the unpleasant experience that some butterflies, and particularly those of the species of Catocala (mourning cloak) will notice his approach from a distance and fly away in time This observation led Tetens to think that these animals must have an auditory organ which warns them of approaching danger by receiving sounds, and accordingly he expressed the supposition that two pit-like depressions at the first posterior segment of the body might be organs of hearing A thorough investigation of this organ, however, has been made but recently by Prof Dr Deegener, the results being published in Zoologische Jahrbücher, Abteilung für Anatomie, vol 27, No 4 1909

It is rather surprising that with a group so frequently collected (although indeed investigated, as a rule only as to their position within a system) as the Noctuidæ, an organ could escape observation which is found quite generally in this group and which is by no means microscopic, but can be observed without difficulty with the naked eye as a striking formation on each side of the first abdominal segment This location probably explains why this organ should have been seen by many persons without arousing the suspicion that it could be a sense organ, for naturally enough such organs are looked for chiefly at the head, particularly at the feelers, although other parts of the body may be the seat of specific sense organs, for instance, grasshoppers have their organs of hearing at the base of the abdomen, that is at the same place where the corresponding organ of the Noctuidæ has been discovered

When examining the animal we see on each side at the line separating the chest from the abdomen and near the points where the rear wings are attached, a deep channel which toward the surface is surrounded by several humps The external morphology of this organ varies in details with the different species of Noctuidæ, with some the opening is scarcely visible from the outside being concealed by long hairs set close together The microscopic examination of a series of sections shows that only one of the ridges in the vicinity of the cavity of the organ, the one nearest the back, can be considered a "sensitory ridge," but that this one has true sensitory cells and sensitory hairs and thus gives the organ the character of a sense organ Tetens's supposition, mentioned above, that this is an auditory organ may very well be maintained since the structure of the organ answers all the requirements of an organ of hearing Still experimental confirmation of this hypothesis will have to be awaited Dr Deegener promises a further report, dealing with this phase of the subject.—Prometheus

Approximately 3,748 miles of new main track were built in the United States during the year 1909 as compared with 3,214 miles for 1908 The 1908 record was the smallest since 1897, when 2,109 miles were built These figures do not include new second third or fourth track sidings or electric lines The net increase during the year is about 16½ per cent, and 28 per cent less mileage was built than in 1907

REINFORCED CONCRETE WATER WORKS CONSTRUCTION

BY FRANK C. PERKINS

The accompanying views of the Indianapolis water works show an interesting application of reinforced concrete to this class of construction A gravity flow supplies the reinforced concrete filter plant from the Indiana State Central Canal which was constructed originally by the State for transportation purposes, but was taken over for water works service At a distance of about 6 miles above the intake to the filters are located the head gates and concrete sluice ways of this canal which is carried over Falls Creek near the filter plant in an open aqueduct at an elevation of about 18 feet above the creek

The chemical house columns, floors and walls as well as stairways and roof are of reinforced concrete throughout. The lower part of the building contains the lime saturating tanks over which are constructed the iron solution tanks all of which are of concrete They are used in connection with the coagulating basins in the treatment of the raw water during seasons of excessive turbidity

The following account of these works is based upon data furnished by the constructing engineer, William Curtis Mabee The water, which is drawn from the Raw River is clarified by coagulation in precipitation basins, which are provided with baffle walls spaced 70 feet apart, and which are reinforced for the prevention of cracks A 4 inch slab of concrete, reinforced with twisted rods spaced 4 feet apart in each direction is used for lining the sloping embankments of earth while the slab floor, laid in blocks 8 feet square, is 4 inches in thickness

The water is measured in a Venturi meter, 42 inches in diameter which has a throat diameter of 21 inches The meter is built in the raw water conduit the indicating apparatus being located in the laboratory

A reinforced concrete pipe line which is 840 feet in length, and has a diameter of 66 inches, and a shell 6 inches thick, conducts the raw water to the precipitation basin The pipe is laid 11 feet below the hydraulic gradient It is reinforced with ½-inch twisted bars spaced 8 inches on centers, the shell of the pipe being built in three operations.

In the construction of the conduit a concrete cradle 20 inches wide was first laid to grade In this were imbedded the lower rods, which were heated and bent in the field to the required shape, and left long enough to project a foot into the upper ring On the cradle were then placed the semi-circular metal forms, which were fastened down by staked timbers. The mixture of cement, in the proportion of 4 of gravel, 2 of sand, and 1 of cement, was poured into the space forming the lower half of the pipe The upper half was then constructed by inverting the metal forms. The cost of the pipe, which contained about 300 cubic yards of concrete, was $12 46 per cubic yard

The pure water reservoir, with a capacity of 5½ million gallons, was built near Falls Creek, on a gravel foundation, at ordinary ground water level. The earth filling is 2 feet deep on the cover, the weight of the structure itself overbalancing any upward pressure that may occur The groined arch bottom was designed to resist the upward thrust of high ground water at such times as the reservoir is empty, the inverted groined arch construction distributing the load uniformly over the bottom. The reinforcement of the bottom consists of ½ inch twisted bars, spaced 10 inches on centers in each direction

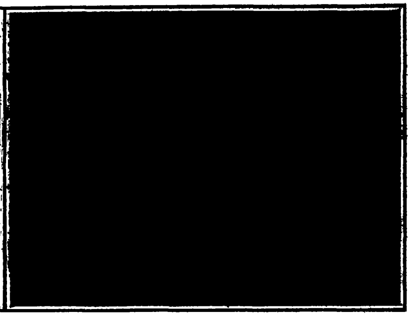
The filter cover consists of reinforced 3 inch slabs, supported by concrete beams, a trifle less than 20 feet long, and spaced nearly 7 feet on centers. The beams are 8 inches in width and 15 inches deep. They are carried on 18-inch I-beams, incased in concrete and bolted to the columns. The reinforced partition walls, 1 foot thick, are 350 feet in length. They are reinforced in both directions, and measure 14 to 17 feet in height. The entire slab covers 70,000 square feet in each double filter It is built monolithic, without any attempt to provide expansion joints. A cable tramway with a span of 450 feet was used in the construction A stationary engine and cable was used for propelling a shuttle car on a narrow-gage track, over which the concrete was handled from the mixer to the cableway, 80 cubic yards per day being used in covering 5,000 square feet of surface The cost of the filter covers was $14 65 per cubic yard, and the cost of the walls $12.06

The reinforced concrete aqueduct, 300 feet in length, contains 4,500 cubic yards of concrete, which cost $6 52 per cubic yard including the cement, steel, sand and gravel, as well as the lumber, forms, labor, and concrete labor It is 41 feet wide and has four spans of 60 feet each with a 10-foot rise from the springing line to the soffit, and a crown thickness of 18 inches for each of the four segmental arches.

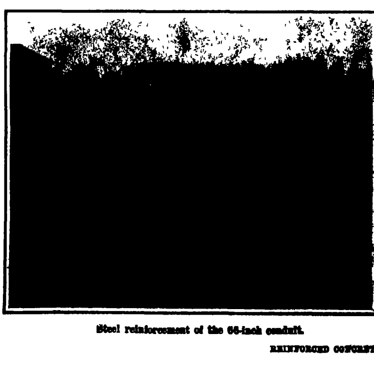
The foundations for the piers, wing walls and abutments were carried down 16 feet below low water, and rest upon a bed of sand and gravel The aqueduct takes the place of a wood aqueduct, which was supported by steel trusses on masonry piers, all of which were carried away by a flood which undermined the middle pier, the superstructure breaking up as the substructure crumbled away

With regard to the use of concrete for works of this character, Mr Mabee, the constructing engineer of these water works, makes the following comments·

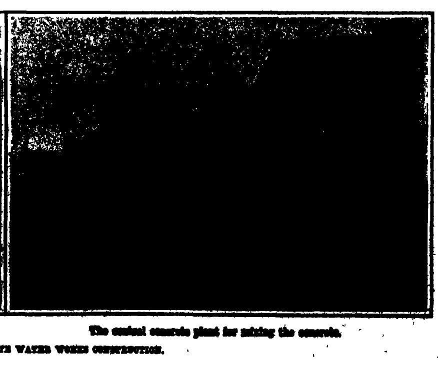
View showing construction of the groined-arch floor, with the reinforcement and forms in place



Operating floor of the chemical house in which the water is purified in lime and iron saturating tanks.



Steel reinforcement of the 66-inch conduit.



The central concrete plant for mixing the concrete.

REINFORCED CONCRETE WATER WORKS CONSTRUCTION.

Concrete has many advantages over other types of construction. It is easily and conveniently handled and transported, often at a less cost than stone masonry, and often suitable sand and gravel for the work in hand can be found on the site. With proper supervision, skilled labor is not essential in the usual work, moreover, the art of mixing and handling concrete has been so perfected that machines do most of the work Concrete has the additional advantage over stone that it may be molded into intricate shapes.

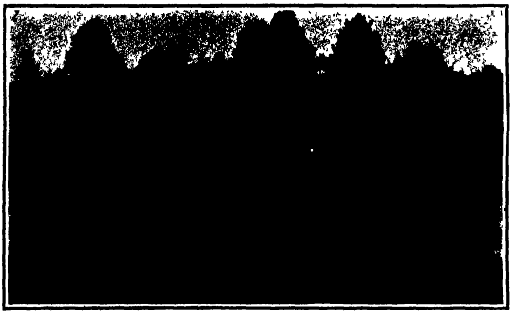
To produce concrete surfaces of a satisfactory smoothness and uniformity, it is necessary that the molds be carefully and properly built, and also that the concrete be of the proper consistency to flow readily into the prepared molds. It is also necessary to thoroughly churn and keep it in motion in the molds until the air has been removed and every crevice filled with mortar Properly handled in this manner, it will not be necessary to brush or plaster the work after the removal of the forms. Concrete may be placed in moderately freezing weather, provided proper precautions are taken to warm the gravel or stone and sand, to heat the water and to cover the work until initial set takes place.

The problem of preventing ugly cracks forming in concrete is one that has worried many engineers. Plain concrete is liable to crack where you least expect it, and it has become the practice to provide for these cracks by building short sections in alternate blocks. However, by the judicious introduction of steel bars, objectionable contraction cracks can be entirely eliminated.

The water works engineer or superintendent is particularly interested in the subject of waterproofing concrete It has been shown that wet concrete is more dense and consequently more impervious than dry concrete and that concrete becomes more or less porous as the quantity of cement is increased or diminished A smoothly troweled surface produces a water-tight film or skin It has also been found that slaked lime added to the concrete mixture helps to make it less permeable. The lime does not injure the cement in any way, although retarding the setting

Coal tar, pitch and asphalt mixtures applied on concrete are used with more or less success. A wash composed of one pound of lye, five pounds of alum and two gallons of water, applied with a brush and well rubbed in, has been used successfully on government fortifications.

A rich cement mortar plastered over concrete makes a very good waterproofing medium Proper attention to these details will produce a water-tight structure, if there is not likely to be contraction cracks, but in works of any magnitude these are bound to occur and they can be best provided against by the introduction of steel bars. A rich concrete properly reinforced, coated with plaster and troweled smooth makes an ideal waterproof structure



Covered reservoir under construction, showing the ground floor, the reinforced slab roof, and the supporting columns.

The Daylight Efficiency of Artificial Illuminants.

In a recent publication of the Bureau of Standards, Mr H E. Ives suggests that there is need of some method of estimating the resemblance of artificial illuminants to daylight, that is, of determining their daylight efficiency Assuming that, by the extraction of certain qualities of light in an illuminant its color could be brought to resemble that of daylight very closely, the daylight efficiency of a source might be expressed in the form (intensity of available white light)/(total intensity of source) Mr Ives suggests two methods of studying this question The first is based upon the use of suitable absorbing screens which, as explained above, could be used to bring the color of an illuminant into near agreement with daylight, though reducing its intensity in doing so Mr Ives presents some spectrophotometric curves of various sources of light, and a diagram illustrating the amount and nature of light from the various sources which must be absorbed to produce white light He also tabulates the "daylight efficiency of a number of artificial illuminants. The method, however, is of practical rather than of scientific interest since it depends upon the particular wave-length for which the intensity is assumed to be unity, when plotting the spectrum curves. In addition, "selective" sources such as the mercury arc lamp which yields a spectrum consisting of isolated bright lines, would work out to zero efficiency according to the above method Yet if we judge by sensation such sources contain a certain amount of white light Mr Ives then proceeds to discuss a second method based on the fact that any color can be matched by a mixture of white light and one ray of the spectrum The ratio of the white light used in attaining such a match to the intensity of the source studied is then regarded as an alternative method of defining white light efficiency which Mr Ives in this case terms "white sensation efficiency" He points out that classification on this method gives rise to materially different results from those arrived at by the former method The efficiency in the case of the second method appears to be higher Yet the result gives no indication of the ability of the source to reveal colors of surrounding objects, and merely indicates the color of a white surface illuminated by the source In conclusion, Mr Ives remarks that the first method is preferable from the practical standpoint, and the latter from the purely scientific one

It is estimated that the Gold Coast and Ashanti could supply 60 843 logs of mahogany and cedar per year if the internal communication were better With mechanical haulage, such as traction engines and light tramways, the output could be increased to some 250 000 logs per annum without depleting the natural reserves.

Aqueduct by which the water is conducted to the filter plant of the Indianapolis water works.

The architectural possibilities of reinforced concrete are shown in this graceful, arched aqueduct.

REINFORCED CONCRETE WATER WORKS CONSTRUCTION.

THE HEAVENS IN MAY

BY HENRY NORRIS RUSSELL

It is seldom that so much of interest to the amateur astronomer happens in a single month as in the one which is just before us

First and foremost, of course, is the return of Halley's comet to the position where it is seen to the best advantage Early in the month it is favorably placed for observation before day break, on the 18th it passes directly between us and the sun, and later it appears to even greater advantage in the evening sky

At the beginning of May the comet is about 74 million miles away, but it approaches us rapidly, its distance diminishing to 41 million miles on the 10th, and 27 million on the 14th As it was about at the limit of visibility to the naked eye on April 12th, while still 135 million miles from us, it is now a fairly conspicuous object

The planet Venus is fortunately near by and serves as an excellent "pointer" to the comet. Anyone, however little familiar with the heavens, can easily find the latter by observing the following directions

Choose a window from which the eastern sky is visible clear down to the horizon Rise about 3·15 A M and look due east. The very bright starlike object, low down in the sky, is Venus The comet is to the left of this and a little higher up at a distance about as great as the length of the bowl of the Great Dipper It will probably be rather fainter than the four stars, forming a great square, which lie above and to the left of Venus, about twice as far away as the comet.

These directions hold good from May 1st to May 12th On the 14th the comet will be on a level with Venus, and a little farther to the left On the 16th it will be much lower than the planet and about 20 deg to the left. After this the comet, or at least its head, can hardly be seen clear of the morning twilight

It will be very interesting to watch the comet grow larger and brighter night by night as it comes nearer to us How long its tail will be it is impossible to predict. The best time to see this however, will in any case be from the 7th onward, when the moon is out of the way and the sky dark The comet will be larger and brighter, too, at this time than previously

Even after the head gets too near the sun to be seen, the tail may be observable in the mornings of the 17th and 18th extending upward and to the right from the eastern horizon, perhaps broad and fan-shaped, from the effects of perspective since the end of it will be much nearer us than the head

On the evening of the 18th or morning of the 19th (according to the observer's longitude) the comet passes between us and the sun, and the earth will be enveloped in its tail if the latter is long enough (over 15 million miles)

If this evening is clear it will be of great interest and importance to look for illumination of the sky In the early evening, just after sunset, the comet's tail will be in the east, but a few hours later it will have passed over toward the west. If, as is sometimes supposed the tail is a hollow cone of light, there will be two times at which the sky in general is comparatively brightly illuminated separated by an interval while we are in the darker center of the tail Meanwhile, observers on the opposite side of our planet will have the rare privilege of seeing the sun through the comet's head Only the extreme western portion of the United States is included in this favored region, but as the comet enters upon the sun's disk at 6 22 P M by Pacific standard time and remains on it till 7.22, the transit will be visible all along the coast. The comet passes almost squarely across the center of the sun from west to east.

Paradoxical as it may seem, it is probable that the ordinary observer, even with a small telescope and dark glasses, will not be able to detect even the slightest trace of the comet's passage With powerful instruments the nucleus, if solid, might be seen as a dark speck against the sun, if it is over 50 miles in diameter, but it is improbable that it is anything like so large, for, as has already been stated in these columns, the whole amount of light reflected from the comet, when remote from the sun, is no more than a single mass 30 miles across would send us.

It is possible, too, that the absorption of the gases composing the envelopes of the head and the tail may be detected by means of the spectroscope, and as we will be looking through the tail lengthwise, nearly 15 million miles of it will be there to exert any possible effect on the sun's light. Even so, it will not be surprising to many astronomers if nothing unusual is detected.

Such negative results will however be scientifically valuable, since they will enable us to say that the materials composing the comet do not exceed certain limits of mass or density

Transits of comets across the sun are very rare. The most remarkable previous instance is that of the great comet of 1882, which, though so bright that it could be seen close to the sun in broad daylight with the naked eye, vanished completely when in front of the sun's disk, showing that it was practically perfectly transparent

On the evening of the 19th we may perhaps already see the comet's tail in the evening sky, though its head will set while the twilight is still very strong. On the 20th, however, it will be visible till about 9 P M, on the 22nd till 10·20, and on the 25th and afterward until after 11 P M.

On the 21st the comet's head will be close to the star γ Geminorum; on the 23rd about 10 deg above Procyon, and on the 25th near ϵ and ζ Hydrae Fuller details will be given later

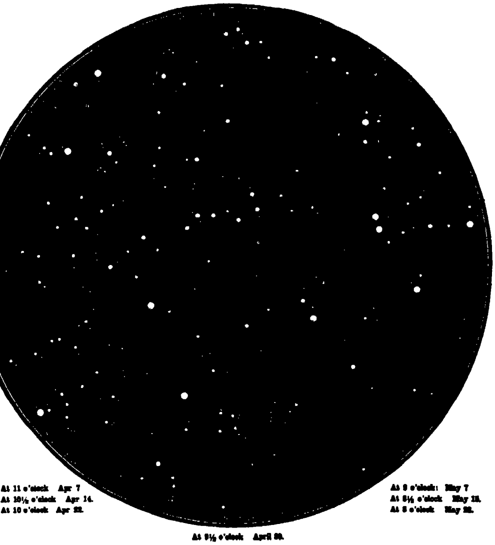
This month is also notable for two total eclipses of the sun on the 8th and of the moon on the 23rd. The former is an important eclipse, the maximum duration of the total phase being over four minutes, but unfortunately the track of the shadow lies almost entirely in the Southern Ocean, only crossing the southern half of Tasmania, so that few stations are available for observers. As a partial eclipse it is visible throughout Australia, New Guinea, and the neighboring islands.

The lunar eclipse of the 23rd is of more interest to us, being visible throughout the United States, excepting Alaska. The moon enters the earth's penumbra at 9·32 eastern standard time, and first touches the shadow at 10 46. At nine minutes after midnight she disappears in it completely, and does not emerge till 1 A.M At the middle of the eclipse, however, her southern edge is only about 200 miles inside the shadow, so that it will be considerably illuminated by sunlight refracted through our atmosphere. At 2 23 A.M the moon takes leave of the shadow entirely, and at 3 36 of the penumbra. This eclipse will be of importance to observers on the Pacific coast, as it will give them a chance to photograph Halley's comet on a dark sky The comet will have set for us in the east before totality comes on

THE HEAVENS

With so much else to engage our attention, our glance at the stars must be short. The most prominent constellations in the west are Gemini and Canis Minor, in the northwest, Auriga, due north, Cassiopeia below the Pole, Ursa Minor and Draco above, and the Great Bear almost overhead. In the northeast Lyra is prominent, and in the east Hercules, Corona, and Boötes. Scorpio is rising in the southeast Due south is Virgo As our initial shows, there is not the slightest resemblance in the stars to the figure for which they were named

We may note the bright star Spica, a spectroscopic binary at a great distance from us, and the double star γ (now close to Jupiter) which is now separable with a small telescope, but in 1835 could hardly be seen double with the largest instruments then existing The two components were then at the closest point of the very eccentric orbit, in which they revolve about one another in some 180 years.



At 11 o'clock Apr 7
At 10½ o'clock Apr 14.
At 10 o'clock Apr 22.

At 9 o'clock May 7
At 8½ o'clock May 15.
At 8 o'clock May 22.

At 9½ o'clock April 30.

NIGHT SKY: APRIL AND MAY

THE PLANETS.

Mercury is evening star until the 25th, when he passes through inferior conjunction, between us and the sun, and becomes a morning star He can be best seen at the beginning of the month, when he sets more than 1½ hours later than the sun. At this time he is in Taurus between Aldebaran and the Pleiades, and should be easy to see.

Venus is morning star, rising a little after 3 A M and exceedingly conspicuous all through the month Mars is evening star in Gemini, setting about 10·30 P M. in the middle of the month, at which time he is quite close to the star ϵ Geminorum (shown on map)

Jupiter is well past opposition, but is visible most of the night, remaining in sight till nearly 4 A. M. on the 1st, and till a little before 2 A. M. on the 31st.

Saturn is morning star in Aries, rising about an hour earlier than the sun in the middle of the month and two hours at its end; but it is too low to be conspicuous.

Uranus is in Sagittarius, and comes to the meridian at 4 A.M on the 19th. Neptune is in Gemini, observable most of the night. On the 29th he is in conjunction with Mars, being 1 deg. 58 min. south of the latter. This may be a good chance for amateurs with

(Concluded on page 388.)

NATURE AS AN INVENTOR

BY PERCY COLLINS

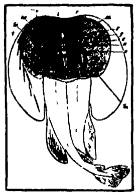
Civilised man justly prides himself upon his numerous inventions and mechanical devices, but it is possible that inventors in general would boast less of their achievements did they realise that the patents in which they have established their rights are really nothing more than modern reproductions of devices which have been employed by Nature from the beginning of time It is a fact that there is scarcely an invention of man that has not its prototype in Nature Sometimes these prototypes are of a rough-and ready character More often, however, they have been brought to the highest pitch of perfection It is little short of amazing that primitive man should have remained blind, through so many centuries, to the significance and value of these inventions of Nature It has been said that almost all of man's achievements as an inventor have their prototypes either in the animal or vegetable kingdom Obviously, therefore, it would be impossible to attempt—in the limits of a short article—anything approaching a complete catalogue of these coincidences Yet a few of them may be selected, almost at random, and they will serve to show how, after much labor and thought, man has perfected devices which at the time appeared to him to be original, although in reality they were nothing more than reproducetions.

As a first instance we may take grasping tools—a whole tribe of implements ranging from surgical forceps and sugar tongs to gasfitters' pliers and the vast pincers by means of which great masses of white-hot metal are manipulated upon the giant anvils of our workshops It is scarcely too much to affirm that, without such tools as these, art, science and manufacture would long ago have ceased to advance The reader needs only to pause for a moment to realize how important a part is played by these familiar implements in the activities of human life, and when mankind first discovered how to make and use such things he must have benefited instantly Yet all these tools have their parallels in Nature, and one is fain to imagine that some of these prototypes might still supply useful hints to modern toolmakers Perhaps the most perfect example of the powerful pincer in Nature is the claw of a crab or a lobster The power of the crab's claw is so great that a bite from a large crab will inflict a severe injury It is related that fishermen who have been feeling for crabs in the recesses of the rocks at low water have occasionally had their hand seized by a large specimen, and being unable to liberate themselves have been drowned by the returning tide Among other pincer-carrying animals are scorpions, while the insects known as earwigs carry a dainty pair of forceps at the end of the body, and employ the tools for folding their ample and delicate wings The opposable thumb and forefinger constitute, in effect a most useful pair of pliers adaptable to many uses and it is strange that man should so long have overlooked the lesson in mechanics which they teach Shears and scissors are of course closely allied in principle to grasping tools yet they have come to us only with the advance of civilization—no savage tribes having the least idea of them or their

(*Continued on page 383.*)


The first bottle—a gourd


The first ball-and-socket joint—a human shoulder


Nature's electric battery—the electric ray or torpedo.


The first spinners a moth whose caterpillar spins the cocoon


The first pump—a heart

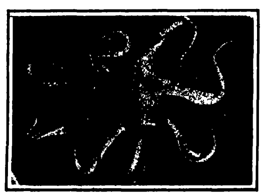

One of the first boxes, a receptacle which holds Brazil nuts, so cleverly packed that, if once taken out, no human hand can put them back again

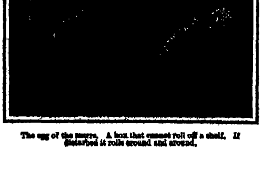

The first hypodermic syringe. The arrangement of lance and saws by which the female mosquito ma[illegible] and enlarges a puncture. The [illegible] assembled form a tube through which venom is injected

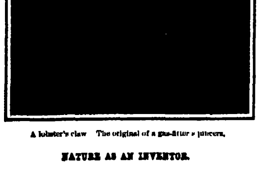

The first balloon the "swellfish" which is [illegible] to inflate itself with air and skip over the water, impelled by the breeze

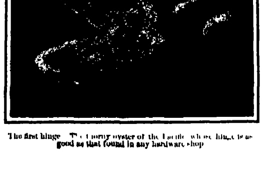

The lantern fly of tropical America. Light without heat—the illuminating engineer's ideal.


The first seamstress. The tailor bird, which stitches the leaves of her nest together


The first "cupping apparatus"—an octopus


The egg of the murre. A box that cannot roll off a shelf. If disturbed it rolls around and around.


A lobster's claw The original of a gas-fitter's pincers.


The first hinge [illegible] of the [illegible] hinge is as good as that found in any hardware shop

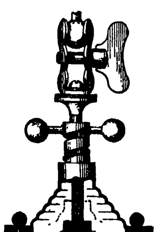
NATURE AS AN INVENTOR.

CURIOSITIES OF SCIENCE AND INVENTION

SUCTION BRACKET FOR MIRRORS.

There is nothing very novel in supporting a device on a smooth surface by means of a suction cup However, the suction support illustrated in the accompanying engraving is provided with a very ingenious method of producing an efficient vacuum The photograph shows a shaving mirror secured by means of a ball joint to the suction bracket and the bracket is supported on a window pane So tightly does the device adhere to the window that it is possible to raise the window by lifting the bracket The bracket cannot be pulled off the glass without danger of breaking the window pane The line drawing shows a sectional view of the bracket, and illustrates the method of producing the suction The base of the bracket is provided with a rubber disk, the center of which is secured to a square shaft on which the mirror is supported Mounted on this shaft and free to turn thereon, is a sleeve in which a spiral groove is cut to receive a pin projecting from the square shaft The sleeve is provided with a pair of ball knobs by which it may be gripped and turned, forcing the shaft outward and thus cupping the rubber disk as indicated by dotted lines There is no possibility of leakage except under the edge of the disk A bracket thus applied will adhere firmly for weeks at a time The stand may be secured to any smooth surface and is particularly adapted for a shaving mirror because it may be placed directly on the window pane where the best light for shaving can be obtained

SHAVING MIRROR ATTACHED TO A WINDOW PANE WITH SUCTION BRACKET.



THE MIRROR BRACKET BROKEN AWAY TO SHOW THE SUCTION DISK

THE OLD "INVICTA" LOCOMOTIVE AS A MONUMENT

A public monument of interest to all who make a study of the evolution of the modern locomotive has recently been set up in Canterbury, England Fixed on a pedestal beneath the Norman walls of the historic city is the old "Invicta engine, which in May, 1830 hauled the first train on the Canterbury to Whitstable Railway—the pioneer iron road of the south of Britain. The locomotive was built by George Stephenson. It will be observed that the cylinders and valve chests are very similar to those on the modern locomotive. The cylinders are 10 inches in diameter with an 18-inch stroke The wheels are 4 feet in diameter The boiler is 10 feet long by 3 feet 4 inches in diameter, and the working pressure was 40 pounds per square inch. The locomotive is now the property of the Corporation of Canterbury It is coated with a special preservative paint.

GEORGE STEPHENSON'S "INVICTA" NOW SET UP AS A MONUMENT

THE TELESCOPE THAT FIRST PICKED UP HALLEY'S COMET

The large reflecting telescope illustrated herewith is interesting by reason of the fact that it was the first instrument to pick up Halley's comet on its present visit to our circle of the solar system To be sure, the comet was discovered on photographic plates made with other telescopes before the photographic record made with the reflector here shown But it was Prof Max Wolf who first identified the comet on a photograph taken with this reflector at the Heidelberg Observatory The discovery was made on September 1st, 220 days before perihelion. The Heidelberg reflector has a focal length of 9 18 feet, and the diameter of the mirror is 28 inches. The mounting is thoroughly up-to-date, and is electrically controlled. The observation platform is adjustable vertically by means of an electric motor

THE TELESCOPE WITH WHICH HALLEY'S COMET WAS FIRST PICKED UP

A NEW COMPETITOR OF THE HORSE.

The "zebrass" has made its bow to the public This creature is a new thing in the world, it never having existed until a year ago It is the hybrid offspring of the African zebra and the Texas donkey There are at the government experiment station at Bethesda, Md, six young zebrasses. Their sire is the royal Abyssinian zebra which King Menelik gave to President Roosevelt The latter turned the striped creature over to the experiment station, and here the idea of developing a new race of animals was conceived. These six young ones are the nucleus. They are regarded as offering great promise. Certain of them combine the docility, strength and utility of the mother with the spirit, activity and beauty of the father The yearlings are already larger than their mother They are beautifully built and should be adapted to the many uses to which the domestic animal is put.

A VALUABLE HYBRID—A CROSS BETWEEN A ZEBRA AND A DONKEY.

TROCHA CUTTER

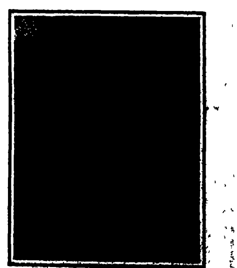
A soldier in the Spanish and Philippine wars, who had abundant experience in endeavoring to get through the wire entanglements of the Spanish trochas, has recently devised a very simple cutter which may be applied to the bayonet of the gun. A soldier in action will disencumber himself of everything except his gun and bayonet, and hence the pliers which are usually furnished for cutting barb wire obstructions are frequently thrown away, so that the only method of getting through an entanglement when encountered is to hammer the wire with the bayonet and a stone. Not only is this process slow, but it is fatal in a galling fire For this reason the inventor has devised a cutter which may be secured to the bayonet without interfering with the use of the gun and which will operate to sever the wire by a single thrust of the weapon. As shown in the illustration, the cutter consists of two jaws pivoted eccentrically so that when extending forward in their normal position they are open, but when pushed back they close In operation, the gun is inverted, the point of the bayonet is rested on the wire, and then the gun is thrust forward with the bayonet sliding on the wire so as to guide the latter between the jaws of the cutter As the jaws are thrust back they close upon the wire and sever it.

WIRE-CUTTING ATTACHMENT FOR GUNS.

RÖNTGENOGRAM OF A FULLY DRESSED MAN.

The range of visible rays from deep red to violet forms a very small part of the solar spectrum Beyond the red, the rays are too long to affect the retina, but we can detect them as heat. At the other end, we have the ultra-violet rays which are too short to affect the retina, but manifest themselves on the photographic plate Röntgen rays are not found in sunlight, but if they were, and if our eyes were so constructed that they could detect only these rays, visible matter about us would take on a very different aspect from that to which we are accustomed The accompanying illustration shows how a man would appear The man appears semi transparent and one can easily make out his two watches and chain, his tie clip and the buckles of his suspenders. The metal parts of the buttons on his coat are also quite evident, and his ribs may be plainly seen A pickpocket might envy such power of discernment, but he would have difficulty in concealing his plunder if others were possessed of similar vision

The photograph was taken instantaneously with a Snooks apparatus, and is reproduced from "Archives of the Röntgen Ray" Heretofore, it has required a long exposure to take a photograph with the Röntgen rays, but recently a system has been devised by which a very sudden and powerful discharge is produced capable of making an instantaneous photograph. This sudden discharge is made by using a fuse in place of the interrupter of an induction coil The fuse is melted when the proper intensity of current is reached, producing a very sudden break of the primary and a powerful discharge of the secondary Exposures of 1/50 to 1/120 of a second have thus been obtained.



The Sketch.

RÖNTGENOGRAM OF A FULLY DRESSED MAN.

It is Easy to make advertising claims for cars; but to make cars that will make good the claims is hard.

We ask automobile buyers to do this: After the advertisements have attracted your attention, then in fairness to yourselves and all the manufacturers, compare the cars *point by point*. That is all we ask.

There are Chalmers dealers in all parts of the United States—more than 200 of them. We suggest that you get in touch with the one nearest to you at once. Let us send you his name if you do not know him.

Chalmers "30" $1500

Judged by price alone you might as well buy some other car as a Chalmers: $1500 is simply $1500—no more in one bank than in another, no more in bills than in coin, no more in your pocket than in another man's.

It is only when you begin trying to buy something with your money that the sense of value enters your mind.

Your $1500 is worth more than another man's $1500, if at all, only because you are able to buy more with yours than he can buy with his.

We believe that when you buy a Chalmers "30" your $1500 becomes worth more than $1500 invested in any other car. Careful investigation will convince you of this fact.

Please remember you are not buying a *price* or an *advertisement:* you are buying a *car*. Therefore examine the *car* on its merits.

If you investigate thoroughly a Chalmers will be your *first choice,* if you are able to get a delivery in your territory.

* * *

It is difficult to get more in a car, at any price, than you can get in a Chalmers "Forty" at $2750. The "Forty" has all the power one can want, the quality to endure, beauty of line and luxurious finish. Seats for seven if desired. **Catalogue "R" on request.**

Chalmers Motor Company

Licensed under Selden Patent

Detroit, Mich., U. S. A.

Chalmers "30" Touring Car and Roadster, $1500

Pony Tonneau, $1600 Inside Drive Coupe, $2100 Limousine, $2750

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

SAFETY DEVICE FOR ELECTRIC LAMPS.—C. W. EISENMANN, Kansas City, Mo. The invention refers to safety devices for use in incandescent lamps using filaments or other incandescent members, the more particular object being to continue the activity of the lamp in case a filament or its equivalent is broken, which would ordinarily extinguish the light altogether.

Of Interest to Farmers.

THRESHING-MACHINE FEEDER.—H. J. BOYER, Chester, Mont. The principal purposes here are to provide a spreading and feeding table for delivering to the draper of the machine the grain-bearing straw to be threshed; to provide a portable spreading and feeding table adapted to deliver the straw upon the draper of the machine as and when extended in opposite directions from the machine; and to provide a mechanism wherein the construction and arrangement are simplified.

HARVESTER.—G. A. TUTTLE, Richland, Wash. This improvement has in view the provision of a harvester so constructed and arranged that it may be operated with a minimum amount of labor to cut the grain and transport it to threshing means where it is threshed and thereafter separated from the straw and chaff, the latter being carried to a straw dump and the grain carried to an elevated position where it is delivered into bags and the like.

PEA-HARVESTER.—G. T. PRITCHARD, Lilly, N. C. In this instance the invention relates to machines for harvesting rice and the like, either from vines or stalks. It is of that type of device which is adapted to rake over the rows of plants, scoop in the vines, strip the peas or rice from the plants, and then separate the peas or rice from the refuse.

COTTON-CHOPPER.—J. A. LANG, Southmayd, Texas. In operation the machine is moved through the field with a wheel on each side of the cotton row. When in position the clutch sleeve is released, thus coupling the operating means for the swinging arm with the wheels. The arm is swung transversely of the row. By means of a lever the swinging frame and with it the swinging arm and the hoes may be lifted clear of the ground, or adjusted to engage the plants whether above or below the plane upon which the wheels travel. Means provide to leave the standing plants nearer together or farther apart.

Of General Interest.

PRESS-BED.—F. C. LEETHEM, Middletown, N. Y. The aim in this instance is to provide a bed having a construction which will enable printing plates to be set up thereupon at any desired point and further to provide an arrangement which will enable the plates to be unlocked or removed at any point without affecting the "lock-up" of the entire bed.

BOILER-BOTTOM.—D. J. LAHAY, Coleman, Wis. The intention in this improvement is the provision of a false bottom with an improved construction which can be readily inserted in an ordinary clothes boiler so as to enable it to be used as a steam cleaner for cleaning lace curtains and other delicate fabrics.

BRUSH.—J. L. ERSKINE, New York, N. Y. The brush is made in sections capable of being readily taken apart for cleaning, sterilizing or renewing any one of the sections in case the same is worn out or injured, thus saving the cost of a new brush. Means provide for the ferrule being relieved of some strain when the brush is used, and this insures a strong and durable brush.

AMMONIA-PURIFIER FOR REFRIGERATING PLANTS.—L. WAGNER, Sedalia, Mo. The object of the invention is to produce a high grade of anhydrous ammonia continuously while the compressor is in operation, and to accomplish this by condensing and separating out the oil and water vapor carried along with the ammonia from the compressor.

INDEX.—R. W. WOOD, Seattle, Wash. An object of this inventor is to provide an index by the use of which a word may be readily indexed up to its third letter, the book or cards of a card index or ledger being conveniently arranged for reference. Still another object is to arrange figures on the leaves or cards so that the user can quickly turn to the page or card of the desired number.

Hardware and Tools.

HAMES-FASTENING DEVICE.—J. W. GOINS, Chattanooga, Tenn. The main object of the present invention is the provision of a simple, durable and efficient fastener for collar hames, one in which the adjustment of the hames shall be easy and rapid. It is an improvement on the fastening for hames that consisted most usually heretofore, in a strap passed through loops on the lower end of the hames metal while the upper end has been drawn together by cinch thongs.

HORSESHOE-CALK.—W. F. ABBOTT, Wilmington, Ohio. Mr. Abbott's invention is an improvement in horseshoe calks, and the object of the inventor is the provision of calks either sharp or dull, which may be removed and replaced without disturbing the shoe, and without recourse to a skilled mechanic.

Machines and Mechanical Devices.

BLOWPIPE.—F. L. McGAHAN, St. Louis, Mo. The blowpipe is of the kind employed in connection with liquid and aeriform fuels, the more particular object being to provide for accurate adjustment in the relative supply of different aeriform bodies, and for causing the admixture of various aeriform bodies to take place thoroughly within the burner.

ROAD-GRADING MACHINE.—C. W. HORTON, Belle Rive, Ill. Among the principal objects which this invention has in view are: to provide a construction whereby a grader may be controlled to operate over an increased area; to provide a structure wherein the operating angle of the grading blade may be adjusted; and to provide a structure simple and durable.

AIR-SHIP.—G. H. BREKKE, Seattle, Wash. Primarily this invention has in view a dirigible flying machine of simple and practical construction under easy and positive control of the operator. The machine is of that type which depends on propellers for suspending it in the air and is more especially designed for carrying the operator only.

DRILL.—J. J. TYE, Rochester, Texas. The invention relates to well drilling machines and is intended to provide various improvements in the manner of actuating the drill rope and controlling the general operations of the machine. It includes novel means for throwing into or out of gear the power operating mechanism and instantaneously hinging the parts into position for operating the drive shaft by means of a hand wheel provided thereon.

CAN FEEDING AND DELIVERING MECHANISM.—J. W. WHITE, Kansas City, Kan. Generally speaking, the invention consists of a chute, can-filling mechanism connected to the chute, a rotatable table, can-feeding means connected to the table, sliding carriages on the table adapted to remove cans from the chute and so place them on the table that they will be located in communicating relation with said feeding means connecting to the table.

Prime Movers and Their Accessories.

ENGINE-GOVERNOR.—J. F. HUNT, Somerset, Ky. The object here is to provide an efficient governor for engines of various types by means of which the flow of motive fluid such as steam, compressed air, water or gas to the engine can be controlled, in which the governor itself can be employed to start the engine, which is positive in its action and which controls the passage of motive fluid to the engine with certainty. Mr. Hunt has used this governor in his shops and on several neighboring saw mill engines, where they have given results superior, he claims, to old style standard governors.

Railways and Their Accessories.

RAILWAY TIE AND CLAMP.—A. M. WAGNER, Pendleton, Ind. The aim in this patent is to produce a tie adapted to be formed of metal and provided with means for supporting and clamping the rail. The special aim is to provide a construction having few parts and to provide also for giving the rail a certain amount of desirable resiliency under a passing load.

RAILWAY-CROSSING.—E. McKEE and B. H. COURSEY, Ashley, Ill. One of the objects of the invention is to provide a simple device which may be automatically operated by the moving train itself or which may be operated by hand, as from a switch tower or other convenient place as desired, for closing the transverse slot so that the wheels of the train may have a continuous bearing surface.

RAIL-JOINT.—C. E. BISER, Selma, and W. W. McCRAE and J. E. McCRAE, Birmingham, Ala. In the present patent the invention is in rail joints. The joint is arranged to be very strong, firm and safe and will be practically noiseless, insuring smooth running of the rolling stock and eliminating jar, thus adding to the comfort of the traveler, and also to the life of the rail and the road bed.

Pertaining to Recreation.

CARD-DEALING MACHINE.—R. A. BRAUN, New York, N. Y. The aim in this case is to provide a machine arranged to permit accurate and quick dealing of the cards one by one without the cards being handled or touched by the dealer, thus preventing cheating, and as the cards are not touched by the dealer soiling thereof by wet fingers is prevented, thus keeping the cards in a sanitary condition.

INCLINED RAILWAY.—A. F. SMITH and A. T. SMITH, Longbeach, Cal. The intention here is to provide a railway for use in pleasure resorts, exhibitions and like places, and arranged to provide a continuous track for a suspended car to travel on, the track having an up-track, a spiral down-track, and a return track with the lower or starting end of the up-track.

Pertaining to Vehicles.

SECURING DEVICE FOR WAGON END-GATES.—L. HILLAN, Wentworth, S. D. The purpose of this inventor is to provide a securing device for the cross bolt that holds an end gate in place, enabling the instant release of the threaded end of the cross bolt for its removal and also for quickly effecting an attachment of the nut that engages the said end of the bolt.

DEMOUNTABLE RIM.—E. J. BUSSEY, New York, N. Y. The improvement pertains to wheels for automobiles and other vehicles, and the aim is to furnish a demountable rim, arranged to permit quick and convenient removal and with it the inflatable tire, and replacing of the rim by another whenever it is desired.

FOLDING GO-CART.—M. FOLGEMAN and A. KRAUS, New York, N. Y. The invention has for its purpose to provide a cart in which the wheels, springs, hood and other similar parts may be folded in the body which may be so closed that it will resemble a dress-suit case, means being provided to secure releasably the wheels, springs, hood, etc., in operative position.

Designs.

DESIGN FOR A COVERED DISH.—L. BOUQUART, New York, N. Y. In this design for a covered dish the ornamental effect is produced in a body formation of dish that tapers down from the top to a flanged and footed base. The cover lines correspond with those of the body portion and converge at the cap or lifter. Handles are placed at each end of the dish.

DESIGN FOR A HAT-PIN.—H. W. SCHWARZ, New York, N. Y. The design includes the usual long and pointed pin and at its head is a ball of relatively small circumference. From the ball hangs a pear-shaped and exquisitely designed drop many sizes larger than the head of the pin.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Distilling coal, H. Koppers ... 956,271
Door closer and check, C. B. Bishop ... 956,275
Door handle, safety, Schuyler & Langhlin ... 956,433
Door hanger, H. E. Ballard ... 956,035
Door lock, J. W. Phelts ... 956,162
Door opener, electric, J. Loch ... 956,379
Door screen, ventilating, I. B. Seeley ... 956,437
Drawing rack, W. H. Willis, Jr. ... 956,013
Drawing table, adjustable, A. Hoffman ... 956,096
Dredging scoop, T. E. Barwis ... 956,989
Drill. See Pneumatic drill.
Drill cuttings, means for collecting, M. L. Sargent ... 956,181
Drinking fountain, R. Kaminsky ... 955,956
Drying machine, J. P. Marshall ... 956,129
Dust collector, G. A. Bauer ... 956,270
Dust guard, L. Y. Williams ... 956,012
Dust receptacle, J. S. Thurman ... 956,450
Dye and making same, blue vat, R. Herz ... 956,345
Dyeing machine, J. T. Psarski ... 955,986
Eaves trough, self cleaning, E. Kreutzberg ... 956,078
Electric and hand power elevator, self sustaining, T. Wright ... 955,932
Electric conductor, armored, P. Schroeder ... 956,188
Electric cut-out, T. E. Murray ... 956,133
Electric generating system, automatic, M. A. Newstetter ... 955,904 to 955,906
Electric light hanger, White & Flowers ... 956,245
Electrical distribution system, A. S. Hubbard ... 956,353
Electrical space communication, G. W. Pickard ... 956,165
Embossing press, O. McCann ... 956,140
Engine igniter, gas, G. Gray ... 956,075
Engine installation, combined reciprocating and turbine, J. Irving ... 956,357
Engine stop, automatic, H. C. Locke ... 956,380
Engines, device for controlling power of explosive, J. H. Schoop ... 955,918
Engines, timer for combustion, P. E. Fant ... 956,[illegible]
Engraving machine, R. Orloser ... 956,[illegible]
Envelope, double, A. E. Harker ... 956,[illegible]
Evaporation and apparatus therefor, method of, N. H. Hiller ... 956,[illegible]
Excavator, power, J. B. Webber, Jr., reissue ... 13,107
Excelsior machine, E. D. Misner ... 956,130
Exerciser, R. F. Bailey ... 956,[illegible]
Eyeglass mounting, F. A. Stevens ... 956,[illegible]

(Continued on page 384.)

THE HEAVENS IN MAY.

(Concluded from page 378.)

telescopes of sufficient size to pick up the faint greenish disk of the planet.

The moon is in her last quarter at 8 A. M on the 2nd, and is new at midnight on the 8th (during the solar eclipse visible in Australia) She reaches her first quarter at 9 P M on the 15th, is full during her eclipse on the night of the 23rd, and comes to the last quarter again at 5 P M on the 31st. She is nearest us on the 8th, and farthest away on the 21st.

During her circuit of the sky she passes close to Venus on the 5th (and likewise near the comet the same afternoon), to Saturn on the 7th, Mercury on the 10th, Mars on the 12th (pretty close), Neptune on the 13th, Jupiter on the 19th, and Uranus on the 28th

Princeton University Observatory.

NATURE AS AN INVENTOR.

(Continued from page 379)

use Those admirable workers in skin, the Kaffirs and Eskimos, employ only knives. The idea of the knife edge in combination with the leverage afforded by tools of the grasping type had never occurred to them Yet shears are exemplified by the jaws of many insects, as well as by those of tortoises and turtles

Only of comparatively recent years has man made boxes in which to store money, trinkets, or other valuables Yet Nature has had her boxes from time immemorial Some of the most interesting of these take the form of seed-pods as, for example the stout casket in which Brazil nuts are packed In this instance, too, the primitive idea of the puzzle—later elaborated by the Chinese, as well as by other races of mankind—seems to lie dormant, for here we have a vast number of nuts, so cleverly packed into their pod or casket, that if once they are taken out it is almost impossible for human hands to restore them to their place

The hinge as attached to a lid or door, has been known to man only for centuries, yet Nature has made use of it literally for billions of years. In proof of this statement, it is only necessary to indicate a bivalve shell, such as an oyster or a clam We know from geologists that such shells are among the earliest indications of life upon this earth with which they are acquainted The eggs of many insects, too, open with a very perfect little hinge, while the little lid which covers the cunningly contrived nest of the trap-door spider, is also hinged in a most ingenious manner by means of silken bands

Savage man had no means of preserving light for himself after the setting of the sun, and it was only with the slow progress of civilization that he became inspired with the idea of artificial illumination Yet this was not for want of examples set by Nature, for many animals carry about with them bright lights during the hours of darkness. Marine organisms, in particular, emit phosphorescent radiance, while many kinds of insects, to which such names as glow worms, fireflies or lantern-flies have been applied, are highly luminous. In many instances the precise manner in which the light of these creatures is produced has baffled scientific inquiry Still, the fact remains that Nature had her living glow lamps ages before man emulated her example

Formerly the surgical operation known as cupping was so constantly performed that scarcely any man attained middle age without undergoing it. The object in view was the removal of blood from some definite spot; the surgeon, by means of his apparatus, calling atmospheric pressure to his aid. Man might very well have invented this operation after examining the numerous suckers which stud the long arms, or tendrils, of an octopus. The principle involved is identical in each case. Indeed, many of man's most useful inventions depend for their efficiency upon the weight of the atmosphere and the creation of a more or less perfect vacuum Like the old fashioned cupping glass the well known toy known as the 'sucker,' reminds us of the octopus By means of the sucker—a small circle of moist leather with a string attached—large stones may be lifted in exactly the same manner that the octopus dislodges rocks or holds down its struggling prey That comparatively modern invention the pneumatic peg is an almost identical device The apex of the peg is fitted with a sort of a cup made of India rubber When this is pressed upon a smooth flat surface, such as a pane of glass the air is forced out of the cup and a vacuum formed The pressure of the atmosphere then causes the cup to adhere to the glass with sufficient force to enable objects to be suspended from the peg Further the man who had studied the octopus might have added to the inventions already enumerated, that of the common pump, which raises water simply by the action of the atmosphere

That well-known device, the ball-and-socket joint without which many of our instruments and tools would be clumsy and impracticable, has many prototypes in Nature Perhaps the most familiar of these is seen in the articulation of the human shoulder bones—or, indeed in the bones of many animals for the marvelous flexibility of the snake is rendered possible only because the vertebræ of this reptile constitute a long chain of balls and sockets beautifully adjusted one to the other Another very perfect example of ball-and-socket movement is found in the case of the sea urchin Each of the spines with which the shell of this creature is covered is swollen at the base into a cup-like form and this cup fits accurately upon a little rounded prominence of the shell, which exactly fits into the cup just as the ball of the human thigh bone fits into the acetabulum The legs of insects in their articulation to the body supply examples of the ball-and socket principle too numerous to mention

The idea of the flask or bottle is eminently natural—i e it has played a part in the economy of Nature from time immemorial Perhaps the most remarkable examples are to be found in the vegetable kingdom among the plants known as gourds, the seed vessels of which assume forms calculated to remind the least imaginative individual of antique pottery

We have already seen that the theory of the common pump might have formulated itself in the mind of man after he had studied the habits and structure of the octopus There is moreover a prototype in Nature for that far more complicated device known as the force-pump This prototype is the human heart Anatomists agree that it is constructed on principles which are marvelously up-to-date In an incredibly short period the whole of the blood in the human body passes to the heart and is driven from it again with a force which carries the stream to the tips of the fingers and toes, while as everyone knows the action of the heart persists, night and day, throughout the whole life of a man If we regard the heart as the prototype of force-pump wrought in metal by the hands of mankind we must still be impressed by its immeasurable superiority Its renovation and repairs are affected while the mechanism is in rapid motion

The simplest form of sewing is that which is in vogue among such primitive races as the Eskimos and Kaffirs It consists in boring holes through the material which is to be joined together and pushing the thread through them The reader will observe that the operation is of so rough-and ready a character that no needle is required, and one is almost tempted to imagine that mankind might actually have copied this method of sewing from having observed the manner in which the tailor bird constructs its nest Be this as it may, the fact remains that this bird actually sews leaves together by their edges, and makes its nest within

the pocket-like receptacle thus formed. Its method of working resembles exactly that which has been detailed above. First the sharp-pointed beak is used to form a slit or hole in the leaf, and through this a piece of tough grass, or other vegetable fiber, is passed. A second hole is made and the natural "thread" is drawn through it, and so on until the work is completed by a tucking in and adjustment of unruly ends. Should the reader care to visit a museum, and make a mental comparison of stitches made by savage tribes and those formed by the tailor bird, he will frequently discover that the latter are far less clumsy than the former. In a word it may be asserted without fear of contradiction that mankind was not first in the field where the art of needlework is concerned. The sewn seam is another of Nature's own contrivances.

The arts of spinning and weaving have also their prototypes in Nature. The majority of nest-building birds exhibit a more or less strongly marked weaving instinct. This instinct is most strongly developed in the case of a genus of finch-like birds indigenous to the warmer parts of Asia and Africa. The spinning of fine threads so as to form thicker strands and the combination of these into webs, are operations characteristic of many insects and their allies. Many spiders, as everyone knows, construct silken webs which they employ as a means of capturing their prey, or of protecting their egg-clusters from injury. But it is among insects of the sub-order *Heterocera* (i. e. the moths) that the spinning of silk has been brought to the highest state of perfection. Moths, indeed, may with justice be termed the first spinners—the inventors under the guiding hand of Nature of this invaluable art. Take, for example, the cocoon of the well-known Cecropia moth—the so-called American silkworm. It is entirely constructed of silk, which is secreted by glands in the mouth of the grub or caterpillar. As soon as the insect has become full-fed, and is about to pupate, it sets about the formation of its cocoon and labors unceasingly until it is completed. The exact method of construction is so intricate that considerations of space forbid us to describe it in detail. Suffice it to say that the caterpillar first constructs of silken threads a kind of scaffolding, or framework, and then—laboring from within—goes to and fro about the skeleton structure depositing its endless silken thread by means of a figure of eight movement of its head. In this way a kind of tent of marvelous toughness is built up, wherein the caterpillar changes to a chrysalis and passes safely through the quiescent period of its existence, to emerge eventually as an adult moth.

In passing, the reader may be reminded that many kinds of caterpillars contrive a kind of trap at the mouth of their cocoons similar in principle to those made by man for the capture of crabs, lobsters, and eels. Within the neck of the Emperor Moth's cocoon, for example, there is a conical arrangement of stout, bristly appendages which form a well-nigh impenetrable barrier against the attacks of enemies which may attempt to force an entrance from without. Yet owing to the flexibility of these appendages, the fully-developed moth can push its way out of the cocoon with perfect ease. If the reader has followed this description carefully, he will perceive that the trap of a moth's cocoon is a veritable reversed counterpart of the familiar lobster-pot—a device which is employed by fishermen in many parts of the world.

The writer is not aware whether Nature's contrivance of a box that cannot roll off a shelf has ever been put to practical use by mankind. It is obvious, however, that such a device might very well form the basis of more than one valuable invention. The principle may be studied by all those who are able to visit the rocky ledges used by sea fowl as breeding places—or, indeed, by those

(Continued on page 386.)

(Continued from page [illegible].)

(Continued on page [illegible].)

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(Continued from page 384)

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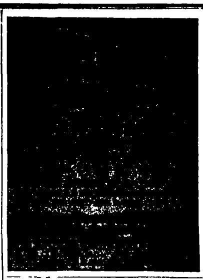

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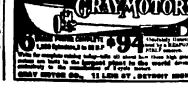

GRAY MOTOR CO., 11 LEIB ST, DETROIT MICH.

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who care to experiment with the eggs of these birds on an ordinary shelf or table. If one sets a fowl's egg rolling on a table, the odds are in favor of its falling to the ground. Not so however, with the eggs of ledge-frequenting sea birds. For the forms of these eggs are designed so carefully by Nature, that it is virtually impossible to impart to them any but a circular movement. If disturbed these eggs roll round and round until the impetus given to them is expended. It is scarcely necessary to dilate upon the importance of this device inasmuch as such eggs, being laid on the narrow ledges of perpendicular rocks would—but for their peculiar form—be precipitated into the sea upon the slightest movement of the parent bird. As it is careful observers have stated that although there is a constant coming and going among the birds and a constant rotation on the part of the eggs not one of the latter is dislodged.

The stings and mouth parts of insects typify in many ways the devices and inventions of man. The sting of a bee or a wasp might well have been taken as a model of the modern hypodermic syringe, so too, might the elaborate arrangement of blades and saws by means of which the female mosquito makes and enlarges her puncture. The instruments, fitted together and working in unison, form a tube through which the insect sucks the blood from her victim and incidentally inoculates him with malarial fever. The several parts of this instrument are shown modeled on a greatly magnified scale in the accompanying photograph. The fact that the sharp blades, tools and saws lie within a sheath when not actually in use is of especial interest, for herein we see typified the sheath or scabbard by means of which mankind protects the keenness of his edged tools and weapons. A still more perfect type of the hypodermic syringe is the fang of a poisonous snake. When the reptile makes its stroke, the base of the fang is driven against a reservoir with the result that the liquid poison is driven through the tubular fang and forced into the wound. Even in the case of large snakes, these deadly weapons are surprisingly slender and delicate, so that the wounds made by them would be quite inconsiderable were it not for the fact that a deadly liquid is injected—exactly as is the case with the hypodermic syringe.

There are many natural devices by means of which plants and animals travel through the air and mankind is at present engaged in a close study of these with a view to perfecting his own air ships and flying machines. The creatures whose appearance and habits resemble balloons most closely are the so-called globe fishes of tropical seas. For the most part their bodies are covered with strong spines, or at least with hard plates, but the strangest characteristic of these ocean dwellers is their power of dilating the gullet with air, when the body swells out into a globe-like form and the spines are erected, furnishing a formidable protection. When so inflated, globe fish are unable to swim. They drift about upon the surface with the underside turned upward, and skim over the waves impelled by the passing breeze. It cannot be doubted that this singular habit reminiscent of the balloon is beneficial to these fish in that it enables them to escape the onslaught of sharks and allied carnivorous creatures of the deep.

In conclusion, we may glance for a moment at Nature's own electric batteries—two remarkable examples of the capacity of animal structure to produce electricity to store it so to speak, and to discharge it at will. Both these creatures are fish, one belonging to the eel tribe, the other being a species of ray known as the torpedo fish. As a matter of fact the torpedo rays belong to several species which are met with in the Atlan

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Pulp fibers from pigments, size, filling and other impurities, separating, B. W. Petsche 955,998
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Rock drill, H. A. Dulmas 956,044
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Shade ornament and weight, combined window, M. A. Happ 955,913
Shaft holder, vehicle, Oller & Hill 956,154
Sharpener, scraper, J. E. Hillstrom 956,350
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Sheet metal box, M. Kamenstein 956,782
Shield, chafing, B. Hall 956,841
Ship and ship's hatch, J. R. Oldham 956,152
Shoe, W. Beck 956,271
Shoe calk attachment, A. Roth, Jr. 956,177
Shutter fastener, H. Zimmerman 956,256
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Sign, Schaefer & Nanry 956,430
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Signaling and fire alarm system, watchman's, G. M. Willis 956,989
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Signaling system, selective, M. W. Sabel 956,285
Siphon, O. F. Plunkett 956,411
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Station indicator and advertising device, C. H. Hopkins .... [illegible]
Steam boiler, Lord & Jones .... [illegible]

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tic, Mediterranean and Indian Oceans. The broad, smooth body has a rounded outline, and on each side of the head there is an electric organ capable of giving electric shocks. The accompanying illustration shows one of these fish dissected to show the seat of its electric power. On the left, the nerves supplying the organ are dissected away. The prismatic areas on the surface of the organ indicate the vertical columns of electrical plates, of which there may be 500,000 in each organ. The arrangement of these plates, or disks, is like the metallic portions of the voltaic pile while each is separated from its neighbor by a delicate membrane, which takes the place of the cloth. The object of this electric power on the part of the torpedo ray appears to be to enable the creature to secure its prey either by killing it, or rendering it temporarily insensible. It is said that just before the shock is delivered, the eyes are depressed in the head like those of a toad when swallowing a large insect.

The electric eel of Southern America sometimes attains a length of six feet, and its electric organs are proportionately four times as large as those of the torpedo. When about to deliver its shock it points its body in the direction of the intended victim, stiffens itself and with a sort of shudder, the electric fluid is emitted. It is said that the fish which is the object of the discharge rarely or never escapes but simultaneously with the shudder of the eel turns on its back and lies motionless—an easy prey to the electric monster.

It would be possible to dilate at much greater length upon the natural prototypes of human inventions. Enough has been penned, however, to show how frequently man's thoughts reflect the devices which already exist in organic nature. The moral to this should not be far to seek. If so many existing human inventions have been anticipated by Nature, we may conclude that with Nature lie the secrets of inventions yet to come, nor can it be doubted that a close study of animal and plant life will from time to time bear fruit in the form of mechanical devices which will prove of inestimable value to mankind at large. For this reason, if for no other, the inculcation of Nature study in the minds of young people is highly desirable.

THE NICE AVIATION MEET.

(Concluded from page 372)

made but one stop, at Litchfield. He started readily from that place at 4:09 A. M. and covered the remaining 68 miles in 1 hour and 21 minutes beating the train that accompanied him. The last 24 miles were flown in 24 minutes on account of a favorable wind. Eight thousand people are reported to have watched him arrive and to have given him a rousing welcome.

Next to the Blériot-Latham race across the English Channel last July, this cross-country flight is the greatest achievement so far in aviation. In the light of what has already been accomplished it would seem that from 800- to 1,000-mile flights without a stop for fuel are now quite possible of accomplishment the only limiting factor being human endurance. In both his attempts at flying from London to Manchester Grahame White was obliged to give up on account of the great strain undergone by him in maintaining the equilibrium of his biplane in the strong and gusty wind. When some device is provided which will maintain equilibrium automatically, the strain upon the aviator will be greatly relieved and driving an aeroplane will then be no more fatiguing than running an automobile.

Siccative powder is prepared by mixing 20 parts of lithopone, 30 of zinc-white and 40 of manganese borate. Pass the whole through a fine sieve. This powder is a good drier for white paints.

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Stencil cutting machine, A. Langsdon ... 958,972
Storage case and exhibition device, combined, E. Streb ... 958,217
Stove grate, Fish & Wightman ... 958,004
Stove reflector, J. T. Renner ... 958,130
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Wheel securing means, R. E. Bergmann ... 958,031
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A printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863 will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

COMPLETION OF THE PENNSYLVANIA RAILROAD EXTENSION AT NEW YORK

SCIENTIFIC AMERICAN

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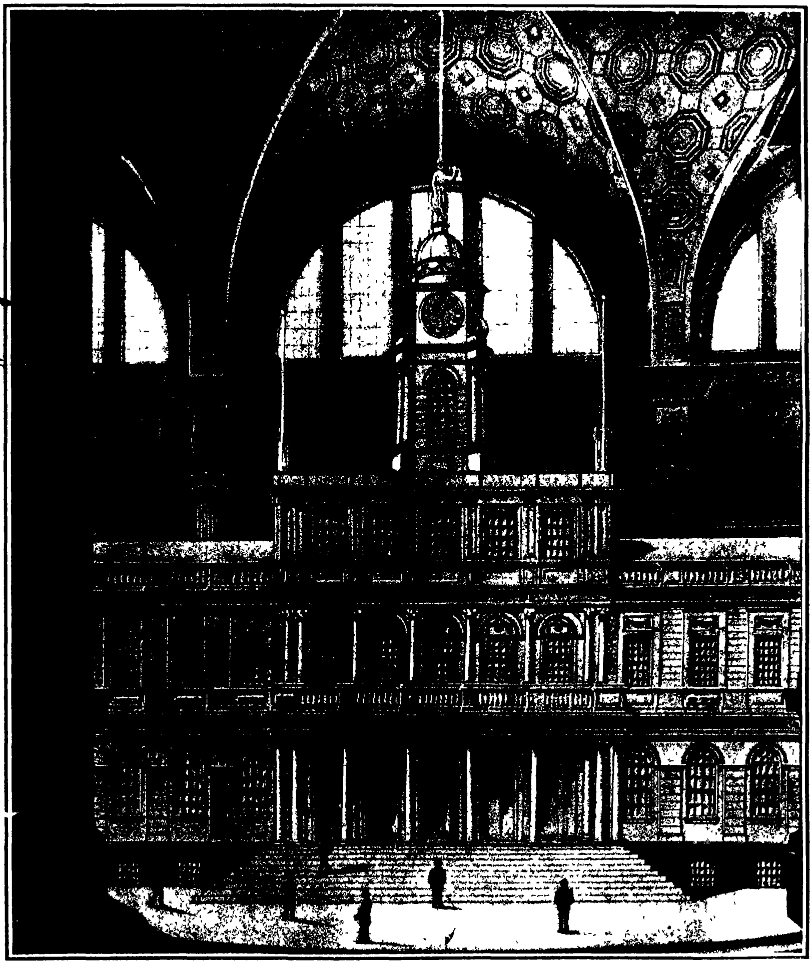

Interior view of the magnificent waiting room which is so spacious that it could contain, bodily, the New York City Hall. The ceiling, 150 feet above the floor, would clear the flagpole by 10 feet.

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NEW YORK, SATURDAY, MAY 14th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

NEW QUEBEC BRIDGE DESIGN

ACCORDING to a recent dispatch to one of the New York dailies, the Quebec Bridge Board, after extended investigation, has approved a plan for the superstructure of a cantilever bridge to take the place of the one which collapsed several years ago. It is also announced that tenders *for construction will be accepted either on this design* or on satisfactory alternative designs submitted by bidders. It is stated, furthermore, that the Dominion government will require not only that the contracting firm accept full responsibility for the project, whether it be constructed on the Board's design or from its own plans, but also that the firm make a very large cash deposit as guarantee of successful completion of the work.

The design now approved by the Commission, says the dispatch, "is that which was sharply criticised a few months ago in an American scientific periodical", and we are informed in this connection that the Canadian government "has decided that the criticism then made did not justly apply". We are further told that "the Board, while convinced that the designs will make a safe and satisfactory bridge, is not disposed to close *the door to other designs*."

Since the SCIENTIFIC AMERICAN is the only journal that has printed the plan of the new design drawn up by the Board and subjected it to extended criticism, we presume that we are the American scientific periodical referred to. The plan and discussion was printed in our issue of February 12th, and our readers will remember that we took exception to the design on the ground that it was not only of inferior merit, considered from the bridge engineer's standpoint, but that if constructed it would be the "ugliest bridge of monumental proportions among those hitherto proposed or built." Objection was also made to the design on the ground that because of its narrow width it would not have sufficient rigidity; the Forth bridge, which is of less span, having a ratio of width to length of 1 to 14, whereas the Quebec bridge would have a ratio of only 1 to 20. We objected, furthermore, to the height of the towers, which in the Board's design is to be only 290 feet, as against a height of 315 *feet in the bridge which fell at Quebec*, and of 330 feet in the Forth bridge. We showed also that the effect of low height and narrow width had been to unduly increase the weight of the structure, the Quebec bridge requiring the enormous average weight of 24 tons of steel (half of it nickel steel) per linear foot, as against a weight of only 10 tons of carbon steel per linear foot in the Forth bridge—an increase out of all proportion to the heavier loading of the proposed Quebec structure.

The value of the Board's decision to invite outside designs depends upon the length of time that is allowed to bidders for the proper preparation of plans for a structure of this great importance. The Board has taken about two years to prepare its own plan, and if outside bidders are to be limited to a few months' time, it is scarcely likely, in view of the heavy penalties imposed, *that they* would be prepared to put in bids, which they must perforce have thrown together very hastily. If the competition is to be thrown open to the designers and bridge builders of the United States and Europe, not only should abundance of time be given for the working up of the necessary plans and estimates, but it would be advisable for the Canadian government to arrange for the plans, both of the Quebec Bridge Board and of outside bidders, to be subjected to the award of an independent Board, preferably international in character.

FUEL ECONOMY AND OUR NATURAL RESOURCES

THE problem of preserving the natural wealth of the country may be attacked from two sides, the legislative and the mechanical. The operation of the first method may be seen in the admirable movement of the Federal government to prevent the ruthless waste of the country's natural resources which results from the improvident methods by which they are gathered from mine, field, and forest. Only posterity will be able to estimate at its full value the recent legislation for the conservation of that natural wealth with which the United States has been so richly endowed.

But after the fostering care of the government has done all that it may to conserve by the prevention of waste, it remains for the consumer to so utilize the raw materials, as to obtain from them the maximum amount of useful output, whether in the form of power or of finished product, with the least possible amount of wastage. This, indeed, is one of the most important and attractive objects *of effort* in the great industrial world. To the engineer of high professional instincts it is not sufficient to do a certain work and do it *fairly well*, rather, it must be done with as close an approximation to perfection as the conditions of the art will allow.

Economy of performance has been the constant aim of the industrial engineer, particularly in recent years, and from time to time we have recorded in these pages certain successive steps, some of them epoch making in their importance, in this constant endeavor to bring working efficiency into closer approximation to theoretical efficiency. What we have said applies with particular force in the field of steam engineering, in which it may be said that at the last analysis the object of all improvements is to lessen the consumption of fuel for a given amount of work. Fuel economy, moreover, apart from its direct connection with the profit and loss account of any industrial enterprise, has a most important bearing upon the *question of the conservation of natural resources*. The world's coal supplies are by no means unlimited. The consumption, enormous as it is at present, is increasing at an accelerating rate, and every reduction that is made in the average amount of fuel which must be burned to secure a given amount of work means that the life of our coal and oil fields is prolonged to exactly that extent.

At the present time there are two important developments which promise to give economical results whose value it would be difficult to overestimate. In both cases they have to do with the transportation of freight in bulk, the one relating to the engines of slow speed cargo boats, the other to the motive power of those huge freight trains which are so characteristic of American railroads.

The reduction in the cost of transporting water *borne freight has been made possible, or soon will be* by the successful application of mechanical reduction gear to cargo ships of moderate speed—a problem to which some of the ablest engineers and the most renowned manufacturing firms in the world are now devoting close attention, MacFarland and McAlpine, and Westinghouse, in this country, and the Hon. Charles Parsons in England have independently produced a gear which will enable slow and moderate-speed steam ships to utilize the highly economical fast running steam turbine for driving slow-speed propellers with a loss of efficiency in the transmission gear of only two per cent. Parsons has gone so far as to test the new installation against the old reciprocating engines, in a cargo ship of 4,500 tons displacement, and he has proved in a series of comparative tests that the cargo ship of the future can be driven at present speeds with a saving in the coal bill of from 17 to 20 per cent. Now since about two thirds of the world's shipping are made up of freight steamers, it can be seen that when some form of this system has been generally applied, as it undoubtedly will be, there will be a great aggregate reduction in the consumption of fuel by the world's merchant marine. For fuller information regarding this epoch making device, reference is made to articles published in the SCIENTIFIC AMERICAN of February 12th and April 23rd of this year.

Equally important are the economies in the transportation of railroad freight which are now rendered possible by the perfection of appliances for the use of superheated steam. Although the application of superheat has been practised *for* several years in Europe, it is of comparatively recent introduction in this country, but although our engineers have been a little late in taking hold of the problem, they have done such good work that on one of our leading western roads, the Atchison, Topeka and Santa Fe, superheated steam is being used on a number of the largest freight engines with conspicuous success. In a series of tests with two identical compound freight engines running over the same stretch of road under identical conditions, one a 4-cylinder compound using saturated steam, and the other a similar 4-cylinder compound with a superheater of the Jacobs type added, the superheater engine showed a decrease in coal consumption of 19.6 per cent for constant hard working on heavy mountain grades; it gave an average of 11.6 per cent more dry steam per pound of coal than the non-superheater engine, and the boiler and its accessories proved to have a total higher efficiency of 15.8 per cent. These figures were obtained by H. MacFarland, the engineer of tests of the *railroad* who explains the remarkable economies secured by the facts: First, that superheated steam of high temperatures behaves somewhat like a gas, it being possible to extract a considerable amount of heat before any condensation takes place, secondly, that for the same cut-off in the cylinder, the weight of steam required is less with superheated than saturated steam of the same pressure, and thirdly, that, as compared with saturated steam, superheated steam has greatly reduced thermo-conductivity, and the amount of heat absorbed by the cylinder walls is only a fraction of what it would be were the steam saturated. The details of this system of superheating as applied to locomotives of the Mallet type will be found in an illustrated article published in our issue of January 29th of the present year.

Important as are the economies that have been made possible in the *broad field of transportation, they are* exceeded in the even larger field of stationary engineering represented by the huge light and power plants for municipal and manufacturing service, where the utilization of the exhaust steam in low-pressure turbines has made possible economies of from 30 to 100 per cent—this last result having been attained at the large station which furnishes power for the New York subway.

DOES RADIUM EXIST IN THE PURE STATE?

THE French scientist G. Le Bon doubts whether metallic radium exists. *In fact*, we are only acquainted with the salts of the supposed metal, such as the chloride or bromide, and the probability of its existence is deduced only from the presence of some rays of the spectrum and an atomic weight which is somewhat theoretical, seeing that it has varied according to the observers. M. Le Bon has been of the opinion for eight years past that the existence of radium is doubtful. He considers that the properties of the supposed metal might be due to certain unknown combinations analogous to the equally unknown combinations which give phosphorescence to some of the sulphides. It is observed in fact that a pure sulphide is never phosphorescent, but when mixed with some traces of different bodies it becomes brilliantly phosphorescent. This point has been discussed in various papers presented to the Academie des Sciences. He had occasion to mention his views about radium to the late Prof. Moissan, and this well known chemist had in fact come to the same conclusion, having the idea of separating radium from its compounds. Death overtook him before he could carry out these researches. A tenth of a gramme of substance would be needed by a good chemist, but probably several operations would be required in addition. An expense of $10,000 would be incurred. M. Le Bon thinks that from chloride of radium we would extract simply barium and nothing more. The experiment, even through transforming a body worth $20,000 a gramme into a comparatively worthless metal, would be of great interest, for it would prove that radio-activity which gives out considerable force can be produced by certain combinations.

M. Georges Claude of Paris brings out the following points regarding the future uses of oxygen, seeing that this latter is now being produced on a commercial scale from liquid air. He shows that oxygen can increase by 40 per cent the yield of the reactions which serve as the base of the fixation of nitrogen by the electric arc, and it can improve the manufacture of ozone by nearly 300 per cent. Such results promise to be of great interest in many of the industries. The Belgian firm of Ougree Marihaye has recently ordered from the Paris Liquid Air Company three apparatus for producing oxygen, and these each have a yield of 200 cubic yards of pure oxygen per hour. Such apparatus will be used for experiments in blast furnace working, to observe the action of a considerable proportion of oxygen mixed with the air, which is sent into the blast furnaces. As to the price of oxygen, although this may be comparatively high when we consider only small quantities, the result changes when we come to using oxygen apparatus of the present kind, and we may count upon a price of 0.64 cent per cubic yard with apparatus of a large output such as we mention. However, even larger apparatus can be built in which no less than 1,000 cubic yards of gas per hour can be produced, working at a pressure of 10 atmospheres and furnishing 1.5 cubic yards per horse-power hour. In such case the price per cubic yard will fall as low as 0.5 cent. By using hydraulic power the cost of production can be still lowered. Oxygen plants of the present kind will be of great advantage in the way of small space occupied, seeing that a small factory [illegible] material needed for [illegible] oxygen [illegible]

ENGINEERING.

The German estimate of aeronautical statistics for the year 1910 is that Germany will have fourteen dirigibles and five aeroplanes; France, seven dirigibles and twenty-nine aeroplanes; Italy, three dirigibles and seven aeroplanes, Russia, three dirigibles and six aeroplanes and England, two machines of each kind

The activity in railroad construction in the Northwest is answerable for the construction of several important bridges across the larger rivers A notable instance of this is the Columbia River bridge on the North Coast Railway in Washington the permanent sub-structure of which will consist of twelve piers carrying a superstructure made up of nine Howe truss spans, and a draw span across the main channel

A leading southern journal speaks words of wisdom when it says that the policy of navy yard construction of battleships should be adhered to, even if it costs a trifle more than building in private yards Keeping our leading navy yards busy with warship construction not only serves as a stimulus to private contractors, but it has the important effect of maintaining the navy yard forces intact, with a large body of skilled workmen ready at all times to undertake emergency work

The loss of the Atlantic transport liner "Minnehaha" upon the much-dreaded rocks at the western end of the Scilly Islands reminds us again that in spite of the additional safeguards which have been introduced of late years in trans-Atlantic navigation the perils of the sea are still insistent The great success of the submarine bell on our Atlantic coast suggests that this device might be used to very good effect at the more dangerous points at the approaches to the British Isles

Nobody seriously disputes the advantages of the "Pay-as-you-enter" car Not the least among these is the reduction which it has made at least on certain lines, in the number of accidents Statistics compiled by the Chicago City Railway show that the complete introduction of this style of car on all trunk lines has resulted in a decrease of accidents of about thirty-two per cent, as compared with the number occurring during equal periods of service with the old style of cars which it replaced

The building of railroads through mountainous country occasionally necessitates some daring bridge construction A recent instance of this is the Assopus viaduct which forms part of a new line extending by way of Demirli to the Turkish frontier The structure which is 600 feet long and spans a gorge 330 feet deep serves to connect two tunnels which open from either side of the gorge The superstructure which is very graceful in design consists of latticed trusses carried upon two hinged arches The bridge is on a grade of about two per cent and the line is laid on a curve of four degrees

Recent tests at Sandy Hook of the resisting power of reinforced concrete as a defense against high powered projectiles confirm the calculations of the penetrating power of the twelve-inch gun It is stated that a concrete wall twenty feet thick heavily reinforced with steel beams, was pierced by a twelve-inch projectile fired at high velocity We understand that a similar attack is to be made with the new fourteen inch gun The blow delivered was sufficient to penetrate twenty two inches of armor plate and the reinforced concrete withstood the attack so well that it will probably be used in the construction of the new coast defense fortifications in the Philippines

The electric operation of trains through the Saint Clair tunnel is showing the same economies as compared with steam operation, as have been obtained in similar installations elsewhere According to the Electric Railway Journal the cost of coal for one year under electric operation was only thirty nine per cent of that for the last year of steam operation The total service charges were but sixty per cent of those for steam, and the sum of service and fixed charges was 84 5 per cent; which represents the operating economy of the new over the old service The cost of maintenance and repairs for the electric system is fifty-five per cent of that of steam during the same period

Considerable interest has been aroused by the launch of the new torpedo-boat destroyer "Paulding" at the Bath Iron Works She will be the first destroyer in our navy designed for the exclusive use of oil fuel Except for this, she is practically a sister vessel to the "Flusser" and the "Reid," and like them she will be driven by turbines, and must make a speed of 29½ knots on a four hours' run at sea. It is well here to correct the statement which recently went the round of the press, that the "Flusser" made 36 knots recently in the Gulf of Mexico. As a matter of fact, her speed on that occasion was between 30 and 31 knots. Her best speed was made on her acceptance trials, when she steamed at an average speed of 33 75 knots. The fastest destroyers are the oil burners of the British navy, which made on trial between 35 and 36 knots.

ELECTRICITY.

In Rochester, N. Y., a good system of electric light and telephone wiring is in use, whereby unsightly pole lines on the streets are done away with The system is applicable chiefly to the residential districts. The lines are placed in underground conduits in the streets but instead of making connections with the houses directly from the underground conduits, a pole line is erected in the back yards of each block and this pole line is connected to the conduits by an underground branch at each side street This obviates the necessity of having a manhole in front of each house

An application was recently made for a permit to lay conduits along the new Baltimore and Wilmington road These are to form part of an underground trunk system connecting Boston New York Philadelphia, Baltimore and Washington, in which the American Telephone and Telegraph Company will run its lines The conduits will be laid just below frost line and will contain a hundred wires which can be tapped at any point It is stated that the system will serve as an auxiliary for the overhead wires which occasionally are put out of order by severe storms It is expected that after the line connecting Boston and Washington is completed, the system will be extended West and South

Storage battery locomotives are being used in certain mines of Germany These locomotives are considered less dangerous than the ordinary electric locomotive for the reason that no wiring is necessary in the mines and they can be incased completely to prevent ignition of gases by means of a chance spark The locomotives are each provided with two sets of batteries one of which is being charged while the other is operating the locomotive The batteries are seldom more than two thirds discharged so that the recharging takes but a short time In one type of locomotive of twenty horse-power the batteries contain ninety cells each with a capacity of 71 ampere hours The storage battery locomotives range from 8 to 32 horse power

Whenever a cable message is sent to an inland city, it is necessary to transcribe the message from the cable receiver and re-transmit it by hand over the land lines to its point of destination Heretofore it has been impossible to send a message directly to the inland city by means of relay connection with the overland wires for the reason that the cable signals are of too fluctuating a character and too sensitive to operate an ordinary telegraph relay Recently a system has been devised which promises to make direct connection between the cable and telegraph systems commercially practicable A very sensitive relay is used and the character of the signal is changed so as to obviate the usual fluctuations By means of this new system a cable message was recently sent from Canso Nova Scotia to New York a distance of 800 miles and here relayed to Chicago

The installation of a complete telephone system for the stage of the New Theater in this city illustrates not only the variety of uses to which the telephone is put but also the vastness and complexity of the up-to-date stage The stage telephone system has nine stations on the stage and twenty five floor stations with two switchboards or central stations Through these centrals inter-communication with the other stations may be had From one of these central stations the technical director controls the operations of the stage hands, while the other board is the stage manager's station The regular stations are placed in the prompter's booth the electrician's booth the stage galleries and one is located near the orchestra leader Calls are made by operating push buttons from either of the central stations and they serve to flash a bull's-eye signal or to operate a buzzer, depending upon which of two buttons is pressed The theater is also equipped with a telephone system used for carriage calls

The Pennsylvania's tunnel and terminal signal installation is the largest single installation of its kind ever made in this country While most people realize that signals play an important part in protecting train movements especially where traffic is congested, the investment made in these devices is far beyond the general understanding Development in signaling in recent years has been tremendous and has proceeded chiefly along electrical lines Complete signaling and interlocking of a double or four track road requires a large amount of electrical apparatus and the introduction of electrical propulsion complicates the situation We are informed by the Kerite Insulated Wire and Cable Company, who supplied the wire and cable for the Pennsylvania Terminal that frequently the cost of electrical wires and cables is from 20 to 30 per cent of the entire cost of the installation Not only from the standpoint of safety, but from that of reliability and punctuality of train service it is necessary that the wires and cables controlling the intricate apparatus should be the best Millions of feet of wire and cable conductors are being used in this installation

SCIENCE.

Prof. W. W. Campbell, director of the Lick Observatory, has telegraphed to Harvard College Observatory that the bright sodium D line has been photographed in the spectrum of Halley's comet by Wright.

Prof. Charles Chandler was honored in New York city recently on his retirement in his 74th year from active service A banquet was tendered him at the Waldorf Astoria hotel The banquet was attended by many of New York's most distinguished scientists

Commander Peary's arrival in England was attended with much ceremony A regiment of reporters met him at Plymouth Members of the Royal Geographical Society as well as the London Naval Attache welcomed him to London With Commander Peary is Capt Bartlett, who accompanied him to the pole A special gold medal was presented to Commander Peary by the Royal Geographical Society and a replica in silver to Capt Bartlett

A letter dated May 1st 1910 has been received at Harvard Observatory from Prof D W Morehouse of Drake University stating that This morning at 4 o'clock Halley's comet had a short bright tail projecting toward the sun Two bright rays bordered the outer part of this sector forming an angle with the nucleus of about 86 degrees The south preceding one was much the brighter The nucleus was surrounded on the sun side with distinct nebulous sheaths Smyth's observation of October 11th 1835 was vividly recalled A photograph of 11 minutes exposure showed a tail of over 2 degrees in length"

The lowest atmospheric temperature ever observed, −68 deg C (−90 4 deg F) was recorded on January 15th 1885 at Werchojansk in Eastern Siberia a little north of the Arctic Circle No lower temperature than this has been experienced by any Arctic or Antarctic expedition A temperature of −59 deg C (−74 2 deg F) was observed in 1876 at 82½ degrees north latitude and the lowest temperature observed by Nansen, at 85 degrees north latitude was −53 deg C (−63 4 deg F) The assertion of Dr Cook who claims to have observed a temperature of −64 deg C (−83 2 deg F) at 74 degrees north latitude in February 1908 cannot be accepted without reserve

The United States Weather Bureau has issued instructions to all its regular stations calling for observations on the 17th 18th and 19th of May of any optical, electrical or other phenomena that may be occasioned by the passage of the earth through the tail of Halley's comet Up to date the development of the tail has been disappointingly slow and it may not extend so far as the earth on the date of transit should it do so however it can hardly fail to make its presence manifest by disturbances in the atmosphere recognizable by the trained observer if not by the layman Such phenomena as mark the occurrence of an abnormal amount of dust in the atmosphere—e g red sunsets Bishop's ring and the singular noctilluminous clouds that were frequently observed after the eruption of Krakatoa are especially to be looked for

A monograph bearing the title "Quality of Surface Waters in the United States" has been issued by the United States Geological Survey The volume which is the work of R B Dole contains the results of over 5 000 mineral analyses of water from the principal rivers of the United States east of the Rocky Mountains Daily samples of water from nearly 200 stations were collected for a year, united in lots of ten consecutive samples from the same stream and station and the composition subjected to analysis The analyses giving as they do the average composition from day to day and information regarding change of water level wherever available form the most complete collection of data regarding the quality of American rivers that has ever been published They are on this account particularly valuable to managers of industrial plants and water works

During the past winter Prof Hergesell of Strasburg president of the International Committee on Scientific Aeronautics carried out a series of daily meteorological observations with sounding balloons over the Atlantic Ocean in the region between Teneriffe and the West Indies The average altitude attained was 15 000 meters and the maximum 16 600 meters which is the record for such observations at sea The lowest temperature yet measured over the sea was also attained viz 70 5 deg C (94 deg F) During December a strong trade wind average 14 meters per second, blew over the Atlantic up to an average altitude of 5 000 meters Immediately above this there was an unusually strong anti trade which had at an altitude of 8 000 meters a velocity of 30 to 40 meters per second The latter wind must have carried an enormous volume of warm air from the tropics to Europe and the unwonted strength of this current may have had something to do with the abnormally mild winter that has prevailed over that continent The isothermal layer was reached at an altitude of 16 000 meters, i e, 4 000 to 5 000 meters higher than it occurs, on an average, over Europe

The Porhydrometer—An Apparatus for Weighing Ship Cargoes

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

An ingenious apparatus has been perfected by an Italian engineer, Signor Emilio de Lorenzi, the function of which is to indicate automatically the weight of a ship's cargo. This device, which is called the "Porhydrometer," is of simple construction and operation, and works with remarkable accuracy—the results being within 0.001 per cent. Moreover, it is easy of installation so that vessels already in service can be equipped therewith as readily as those in course of construction.

The operation of the instrument is based upon the principle that a body floating in a liquid no matter what its density may be displaces a quantity of that liquid exactly equal to its own weight. The apparatus comprises merely a float or "aerometer" placed in a chamber filled with water, which is in communication with the outside of the ship. Consequently, as the vessel sinks deeper into the water while being loaded or *vice versa* when the freight is being discharged, the level of the water in the float chamber must rise or fall in coincidence with the level of the surrounding liquid outside. The float itself being fixed it becomes more or less deeply immersed in the water in the chamber with a consequent alteration in its apparent weight.

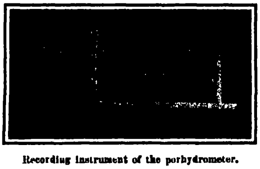
The aerometer is connected and balanced by levers so that by the adjustment of the balancing weights the volume of water displaced by the aerometer at any particular draught is accurately gaged the alteration in apparent weight being read on the weighing machine or recording instrument and therefrom the weight of any cargo taken on board or discharged is easily determined.

The principle of the apparatus may be more comprehensively realized by reference to the explanatory illustration which shows the midship section of a vessel with the porhydrometer in position. The float chamber *A* is placed vertically over the longitudinal and transverse center of the ship and extends from a point 1½ to 2 feet below the line of flotation when the vessel is empty to a convenient height above the load line. This chamber is connected to the surrounding liquid by means of a smaller pipe *B* to a valve on the skin of the vessel, or to some other convenient sea water connection. A special tube being unnecessary so long as an uninterrupted flow of water to the float chamber can be secured so that the water level within may be exactly as that outside the ship. In the large float chamber *A* is immersed the aerometer *C* being suspended from, and balanced by a horizontal lever *D* having its fulcrum at *E* the other end being connected to a steelyard weighing machine at *F*. The aerometer is generally made heavier than its displacement, but this is immaterial since it is in a condition of equilibrium. The float extends downward sufficiently to bring its lower end below the plane of flotation for light loading, and sufficiently far upward to bring its upper end above the plane for the maximum draught. Moreover, its profile is such that the area of the float at any point of cross section bears a constant ratio to the area of the ship at the same level.

As the vessel becomes immersed through the superimposition of any weight such as cargo, the draught increases and accordingly the water in the float chamber rises to a higher level, the aerometer itself consequently being immersed deeper into the water, and by increasing its displacement reduces its apparent weight as already mentioned. This difference of weight creates a downward pull on the opposing arm of the lever, where a counterweight remains unaltered. As the steelyard is connected to the main lever *D* by tie rods or links the exact amount of tension is registered that is attributable to the disturbance of the balance on the main lever through the increased displacement.

The vital part of the invention lies in the aerometer. Alteration of trim or inclination of the vessel cannot by any means upset the accuracy of the instrument. It is in short an absolute gage of the vessel's displacement. Should the cargo be placed right aft or forward it will be weighed exactly the same as if placed near the center of the vessel, since the draught directly under the instrument is the mean of that fore and aft. The whole of the parts of the apparatus are standardized with the exception of the aerometer, which must be properly designed and carefully adjusted, its form being made to correspond with that of the ship.

Numerous tests with the apparatus have been carried out in England, and the accuracy of the weight readings, irrespective of the size of the vessel, have been remarkably conclusive. It can be applied to any type of craft with equal facility and infallibility—to a small lighter as easily as to a transatlantic liner. At the present moment arrangements are being made for its installation upon a 10,000-ton vessel. In this case the diameter of the float will be about 9 inches. For a small lighter it averages about 3¼ inches diameter at the top by about 2¾ inches at the lower extremity. So sensitive is the apparatus that it will indicate the weight of a person stepping on board.

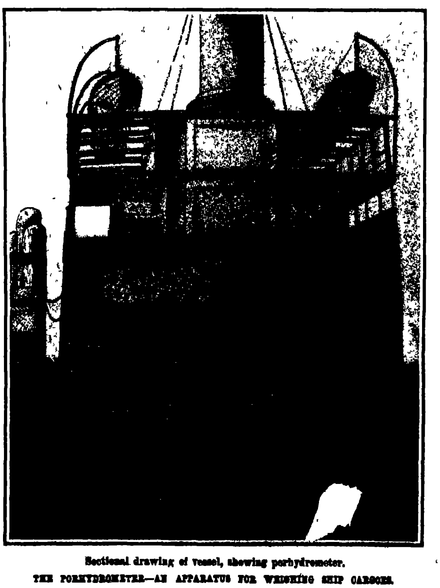


Recording instrument of the porhydrometer.

Thus it will be seen that the captain of a vessel always possesses a means of determining exactly the weight he has on board. For those vessels engaged in long journeys, necessitating bunkering at intermediate ports, it is of far reaching importance, since it enables the captain to ascertain precisely how much fuel he has shipped. This is a valuable point, inasmuch as at many foreign ports short weighting is by no means an uncommon practice, and vessels are often mulcted for a considerable sum per annum in payments for misrepresented quantities of coal.

The function of the invention is also carried to a further and important feature. It will inform the captain the exact weight of water he has in his ballast tanks. Also, should the vessel spring a leak the fact is instantly communicated to the captain by the apparatus registering an increased weight or displacement due to filling with water. In cases of collision and grounding the incursion of water is similarly conveyed, the apparatus being equipped with an electric alarm bell, which conveys intimation of the danger to the captain. No discrepancies in the readings can be introduced by variations in the density of the water in which the vessel may be floating, for such cannot affect the fundamental principle upon which the apparatus works.

It will be seen that by the introduction of the apparatus the ship itself is practically converted into a huge weighbridge. The Italian government submitted the invention to searching tests and was so convinced of the accuracy of the records that its customs authorities have been ordered to accept porhydrometer readings as correct. To the shipowner this is no slight concession, since in regard to Italy, instead of paying 4.5 cents per ton in weighing dues, vessels fitted with the porhydrometer only pay 1.25 cents per ton.



Sectional drawing of vessel, showing porhydrometer.

THE PORHYDROMETER—AN APPARATUS FOR WEIGHING SHIP CARGOES.

Influence of Phase and Rotation upon the Brightness of Illuminated Spheres.

The total luminosity of the moon varies according to the proportion of its illuminated hemisphere which is turned toward the earth, that is to say, in accordance with the "phase" of the satellite. Mercury and Venus show similar, but smaller differences of phase and brightness. The exterior planets vary in phase so little that the variation in their brightness is barely perceptible. The brightness of planets can be measured by the astrophotometer, and the dependence of the brightness upon the phase can be expressed by a curve. As it seemed possible that some information in regard to the surface of the planets could be obtained from the study of such curves, Von Aufsess has made a series of experiments to determine the relation between brightness and phase in the case of illuminated masses of limestone, sandstone, granite, and other materials of spherical and other forms. The measurements of brightness were made in a completely dark room. The artificial plant was illuminated by a Nernst lamp, not directly, but by reflection from a plane sheet of glass, through which the object could be observed in the "full" phase. The lamp and the reflector were mounted on an arm which could be turned around the object in order to vary the phase.

When the results were plotted, the curves representing the brightness as a function of the phase were found to fall into two classes, according to the character of the material to which the globes were composed. Globes of light colored material gave curves concave below, while the curves produced by globes of darker material are concave above. Small elevations and depressions, glossy surfaces, etc., were found to produce comparatively little effect upon the curves, the character of which was, in general, decided almost entirely by the lightness or darkness of the surface. The curves produced by Venus and the moon are concave above. Hence it appears probable that the surfaces of these two planets are formed of dark colored material.—Prometheus.

In a recent issue of Nature the difficulty experienced in hot countries in keeping small accumulators in working order is referred to, and it is pointed out that this is probably due to the cells being filled with dilute acid of density 1.190 at a temperature of 30 deg. or 35 deg. Cent. While this is a proper density to use in a climate where the temperature is 15 deg. to 20 deg. Cent., corresponding to a 20 per cent mixture, it is too high for a hot climate, where it really represents a 23 per cent mixture; a density of 1.170 or even 1,150 is more suitable.

THE NEW EIFFEL PHOTOGRAPHIC HELIOGRAPH.

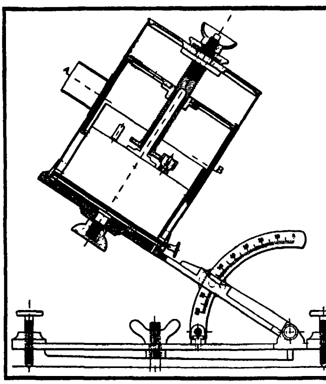
BY JACQUES BOYER.

Bouguer, in order to measure the luminosity of the sun's disk, allowed a beam of sunlight to enter a dark room through a small aperture, behind which a converging lens was placed. The diverging cone of rays, beyond the focus of the lens, was intercepted by a screen, forming a circle, the brightness of which was not too great to be measured by the ordinary methods. The brightness of the sun was assumed to bear the same ratio to that of the circle on the screen that the area of the circle bore to that of the aperture through which the light entered. At a later date (1844) Fizeau and Foucault employed the photographic process which had just been discovered by Daguerre to compare the brightness of the sun with that of artificial sources of light. The quantity of light received by a unit of area of the solar image formed at the focus of a telescope is proportional to the clear aperture of the object glass. Fizeau and Foucault received the image of the sun on an iodized plate of silver. In successive experiments they varied the aperture of the objective and regulated the duration of the exposure so that the final tint assumed by the plate and, therefore, the quantity of silver iodide decomposed, was the same in each case. In this way they proved that the required length of exposure, within certain limits, varied inversely in proportion to the aperture of the objective In other words, the total chemical effect was found to be (within the range of exposure) proportional to the total quantity of light received by the image during the exposure Then, by comparing the image of the sun with that of a circular area, of the same apparent diameter, of the positive carbon of an electric lamp, they proved that the chemical effect is proportional to the brightness of the source of light. This relation, however, did not appear to extend indefinitely, for the quantity of silver reduced, which was at first proportional to the length of the exposure, tended toward a fixed limit when the exposure was greatly prolonged

In 1881 the great advance which had been made in photography enabled Janssen to employ very sensitive plates, in which the total chemical effect remained proportional to the duration of exposure within very wide limits Jordan devised a heliograph in the form of a perforated cylindrical box containing a sheet of ferroprussiate paper, and Richard constructed another instrument based on the photographic action of the solar rays.

Campbell, on the other hand, made use of the heating effect of the solar rays for the purpose of measuring the effective annual duration of sunlight, i. e., the aggregate time during which the sun is not veiled by clouds, a quantity which plays an important part in the processes of vegetation. Campbell's heliograph consists of a sphere of glass, mounted on a horizontal base, in a place exposed on every side, so that the sun is visible from its rising until its setting. A groove in the spherical mounting allows the introduction of a strip of cardboard, which forms a circular arc at such a distance from the spherical glass lens that the image of the sun, formed by the lens, is always on the strip The cardboard is carbonized by the concentrated solar rays at the spot where the image is formed and, owing to apparent diurnal motion of the sun a black line is traced on the card If the sun shines all day without intermission this line is continuous but if the solar rays are intercepted by fleeting clouds the trace consists of a number of separate portions the portions and lengths of which show when and how long the sun has shone The apparatus is easily set up It is necessary only to level the base, to place the noon line, marked XII on the card opposite a fixed mark on the frame and to set the instrument so that the sun's image falls exactly on this line at the instant of true noon In the improved form of the instrument designed by Stokes the frame has three grooves, at different heights, in which three sorts of cards are placed The shortest cards are placed in the highest groove and are used between November 5th and February 5th, the longest cards are placed in the lowest groove and are used between May 5th and August 5th, while the cards of intermediate length are placed in the middle groove and are used during the remainder of the year

THE EIFFEL PHOTOGRAPHIC HELIOGRAPH.



VERTICAL SECTION OF THE EIFFEL HELIOGRAPH.

Eiffel has recently invented a photographic recording heliograph which has been used for some time at the central meteorological bureau of France and at the Juvisy observatory It consists of a cylinder which is mounted on a shaft parallel to the earth's axis, and is turned by clockwork at the rate of one revolution in twenty four hours. The sun's rays enter the cylinder through an aperture in its convex surface which is surrounded by a hood for the exclusion of diffused light An inner cylinder, covered with photographic paper, is supported by a nut which can move along the shaft of the outer cylinder which shaft bears a screw thread A guide, attached to the case of the clock work, prevents the inner cylinder from rotating Hence as the outer cylinder turns, the inner cylinder is compelled, by the screw, nut and guide to move along the shaft without rotating The photographic paper is surrounded by a screen, which has various degrees of transparency in its various parts corresponding to the average intensity of sunlight at different hours and seasons As the outer cylinder rotates, its aperture is always directed approximately toward the sun and in consequence of the motions of the two cylinders, the entering pencil of light traces a helicordal line on the paper which is wide enough to serve for a number of days No new conclusions can be drawn from the photographic records made by the Eiffel heliograph until after the instrument has been in continuous operation for several years

CARDIN PROCESS OF PHOTO-SCULPTURE.

The idea of employing photography as an aid to sculpture soon followed the invention of the daguerreotype Fifty years ago Willème devised a process in which the sculptor's model was photographed simultaneously by twenty four

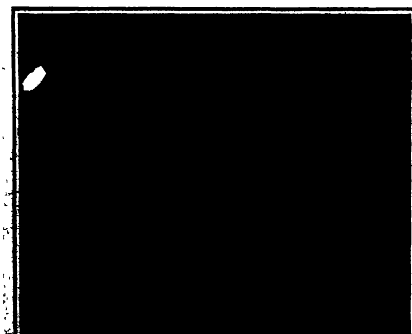


Fig. 2.—Cardin's apparatus for photographing the sitter from the front, back, and both sides simultaneously with a single camera.

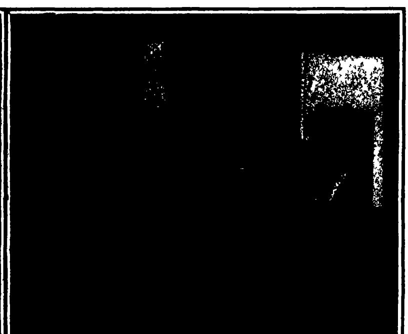


Fig. 1.—Cardin's apparatus for modeling from four photographs.

THE CARDIN PROCESS OF PHOTO-SCULPTURE.

cameras, arranged in a semicircle. A paper positive is made from each of the negatives and the twenty-four prints are cut out along the outline of the figure, and are then cut in two vertically The forty-eight profiles thus obtained are assembled radially about a vertical axis in their proper relative positions. By filling in the intervals with a plastic mass a fairly complete sketch of the figure is obtained

This process may be varied as follows A mass of clay or modeling wax is placed on a revolving circular platform, the circumference of which is divided into twenty four equal parts The approximate form of the model having been given to the mass by the usual methods, the outline of the figure in one of the (entire) photographs is followed with the tracing point of a pantograph, which is so constructed and arranged that its copying point plows a furrow in the mass of clay The platform is then turned through one division and a second furrow is made from the second photograph This process is repeated with each of the twenty four photographs, and the clay between the furrows is carefully removed A very skillful hand is required to perform this operation so as to reproduce every detail of the model, but the object of this and all other processes of photo-sculpture is to produce, not a finished statue or bust, but a sketch as nearly accurate as possible

The new Cardin process possesses the advantage of requiring only one photographic camera. Fig 2 illustrates the method of making the photographs required for a portrait bust. The sitter is posed, facing the camera, before a triple mirror, by means of which the back and sides of the head are photographed by reflection As the sitter's face and the three virtual images formed by the mirrors are unequally distant from the lens, the four images formed by the latter are not in sharp focus in the same plane For this reason the ground glass focusing screen is made in four sections, and the plate holder is contrived to hold four plates, side by side, but in slightly different planes The same cause produces differences in the scales of the four photographs, but in making the enlarged copies which are employed in the operation of model ing, these differences are easily removed with the aid of the plummets which are suspended above and at each side of the sitter's head, and which appear in each photograph and indicate its scale

The modeling apparatus is shown in Fig 1 A vertical post rises from the center of the square iron platform *S* Two photographs, a front view *T* and a profile *E* are supported in a vertical position by frames which slide in guides bordering two adjacent sides of the table These sides are furnished with jointed supports which carry long rods, *A* and *B* The rods can slide lengthwise in their supports and can be inclined and moved vertically and horizontally by means of the joints of the supports. The rods are used horizontally if the bust is to have the same scale as the photographs, and are inclined for enlargements and reductions. The movement of the photograph frames in the guides is limited by fixed stops, so that the frames can be removed and replaced exactly in their former positions

The rods and their supports are adjusted to bring the inner end of the rod *A* into contact with a conspicuous point, the tip of the nose, for example, in the full face photograph *T* and the inner end of *B* into contact with the corresponding point of the profile *E* The frames containing the photographs are then removed and the rods *A* and *B* are pushed inward in their supports until their inner ends meet The point of meeting determines the position of the top of the nose of the bust. The post at the center of the table is covered with clay or other plastic material, which is built out until this point is established in tangible form The rods are then drawn back, the photographs replaced and a second point of the face is established by a repetition of the process. In this way numerous points distributed over every part of the bust are fixed, each pair of adjacent sides of the table, and the corresponding pair of photographs, being employed, as required The result is an almost complete sketch, obtained from a sitting of a few seconds. All of these operations can be performed by a skilled workman. The hand of the sculptor is called into requisition only to give a few finishing touches in another brief sitting, and to impress an individual artistic character upon the work.

HALLEY'S COMET IN THE EVENING SKY.

BY HENRY NORRIS RUSSELL, PH.D.

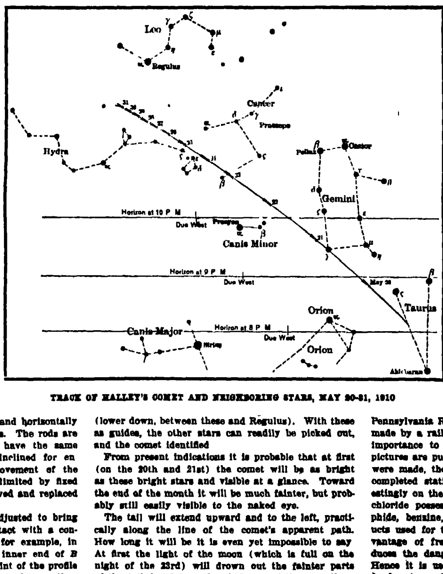
The average man will find by far his best opportunity to see the comet, which has occupied so prominent a place in public attention, during the last ten days of May The accompanying map shows at a glance just what are the circumstances of its appearance. At first its apparent motion among the stars is very rapid, but later, as it recedes from us, it seems to stand almost still in the sky Its distance from the earth is in round numbers 14 million miles on the 20th, 17 million on the 22nd, 28 million on the 26th, and 45 million on the 31st, so that it will appear to shrink and grow visibly fainter from night to night.

In addition to the stars near the comet's path, and the place of the comet for each night (at 10 P M Eastern Standard Time, or 9 P M Central Standard Time, etc.), the map shows the position of the horizon among the stars at certain hours, so that it is easy to estimate how high up they will appear at any time

The given position of the horizon is exact for observers in latitude 40 deg north (Pennsylvania, Ohio, Illinois, Utah, northern California)

Those south of this line will see the stars on the right (on the map or in the sky) somewhat lower, and those on the left somewhat higher, at the same hour In any case it will be easy to identify them by their relative positions.

Those unfamiliar with the constellations may well begin with the four brightest stars Regulus (at the end of the sickle-shaped group shown on the map), Castor and Pollux (close together), and Procyon (lower down, between these and Regulus). With these as guides, the other stars can readily be picked out, and the comet identified



TRACK OF HALLEY'S COMET AND NEIGHBORING STARS, MAY 20-31, 1910

From present indications it is probable that at first (on the 20th and 21st) the comet will be as bright as these bright stars and visible at a glance. Toward the end of the month it will be much fainter, but probably still easily visible to the naked eye.

The tail will extend upward and to the left, practically along the line of the comet's apparent path. How long it will be it is even yet impossible to say At first the light of the moon (which is full on the night of the 23rd) will drown out the fainter parts of the tail, but later, when it is out of the way, these may perhaps be seen, though the comet will be so much farther off that, on the whole, it will hardly be so fine a sight.

In observing it telescopically, the eyepiece of lowest power, giving the largest field of view, will be most satisfactory

Princeton University Observatory

The Elasticity of the Earth.

Some interesting experiments have recently been carried out by Prof Milne, F.R.S., the well-known authority on seismology, to demonstrate the elasticity of the earth especially under the influence of the tides. Some years ago he showed that valleys during the day are of greater width than at night, there being an expansion or opening out under the action of the sun and a contraction or closing up in the hours of darkness. He also showed by means of seismographic records secured at his observatory at Shide, that the Isle of Wight alternately moves forward and backward with the variation of the tides, the greater pressure of the water at high tide in the English Channel as compared with that in the Solent and Spithead causing the island to be tilted upward bodily from the channel side.

His latest experiments in this direction have been carried out in connection with the Irish Sea at the mouth of the Mersey. A special type of seismic recorder has been devised and has been set up in an underground position at Bidston Observatory near Liverpool, some two miles from the water's edge. The apparatus comprises, as it were, a mast and a boom, such as is used in the professor's earthquake recorders, the boom being free, so that as the mast moves in one direction or another the boom can also move. A photographic recorder is connected to the apparatus so as to secure a permanent visual record of the oscillations. The instrument is far more sensitive than that employed for ordinary seismic operations, thereby indicating those very slight movements of the earth which the ordinary apparatus would ignore.

The records secured by this instrument conclusively prove that twice every twenty-four hours the opposite sides of the tidal basin are drawn closer together, the phenomena occurring at high tide when the increased volume and weight of water piled up in the Irish Sea and pressing on its bed causes the latter to sag somewhat. The action can be watched, for when the tide is flowing quickly and the tide is high the pendulum moves a considerable distance and keeps pace with the deflection due to the increasing load. At Bidston the weight of the tide off the mouth of the Mersey causes a deflection of about one inch in a distance of sixteen miles. As the tide ebbs and the weight is reduced the sag diminishes like a dent in an India rubber ball, and the banks on either side slowly recede from one another The extent of this attracting and repelling movement would be more accentuated upon the instrument were the latter placed nearer the sea, and Prof. Milne points out that for this reason observatories should not be situated too near tidewater The regular alternate movements of the apparatus in opposite directions every six hours not only, as it were, record the extent of the elasticity of the earth's crust, demonstrating that it is responsive to pulls and strain to a far greater degree than is generally believed, but also weigh the tide itself The result of these experiments should provide a new field for investigating tidal forces and phenomena, and possibly contribute to our knowledge thereof.

The Current Supplement.

Almost the entire issue of the current SUPPLEMENT, No. 1793, is devoted to a complete description of what is known as the New York Tunnel Extension of the Pennsylvania Railroad, the costliest improvement ever made by a railroad, and one of the most far-reaching importance to industry and to the traveler. Many pictures are published, showing the excavations which were made, the progress of the work, as well as the completed station. Dr. Otto Hoffmann writes interestingly on the system of the universe. Carbon tetrachloride possesses in comparison with carbon disulphide, benzine, gasoline, and other petroleum products used for the extraction of oils and fats, the advantage of freedom from inflammability, which reduces the danger of fire and the cost of insurance. Hence it is used frequently as a harmless substitute for benzine and gasoline in cleaning clothes. An article on the subject appears in the SUPPLEMENT. Mr. Henry A. Wise Wood's excellent paper on Modern Stereotypy is concluded.

Recently Mr. W. Casmey, of Leeds, read a paper before the Rotherham Engineering Society on "Engineering in the Boiler House." Mr. Casmey stated that there was an indication that the factory chimney would be supplanted by mechanical drafts or fans, as the cost of maintaining steam by such methods was only about one-sixth that of chimney draft. He pointed out that while steam gages and water indicators had long been in use, stokers had no assistance in ascertaining the volume of air necessary for combustion. A full combination indicator had, however, been invented for this purpose, consisting of a gage actuated by the draft of the chimney and having a graduated scale giving the pounds weight of coal burned to the square foot of grate per hour.

Wireless Telegraph Apparatus for Contestants of the Glidden Tour

BY RENÉ HOMER

In the district selected for the annual Glidden tour this year, ordinary telegraph communication will be very difficult, and at times impossible. In 1909, although the tour passed through a comparatively well-settled country, the whereabouts of several of the contestants were often unknown for hours. One car, for instance, failed to report at the night control, and no one knew what had happened until the next morning. On another occasion a passenger was injured in an accident, and nothing was known of the matter until it was reported by a belated tourist at the night check ing in. Many minor difficulties were responsible for considerable delay that could have been prevented if the cars had been in communication with the last control.

Bamboo aerial set up in car.

The Chalmers-Detroit Company propose to keep in touch with the contestants by means of wireless telegraphy. Complete plans have not been worked out yet, but it seems probable that some such scheme as the use of three field wireless stations will be favored, two of the stations carrying on communication, one of them being in touch with the wire system, while the third station is being established at some advantageous point ahead of the contestants. The exact details of the plan will be furnished after a trial car has had a chance to go over the worst portions of the proposed route.

In the early part of March successful wireless telegraph tests were made for the Chalmers-Detroit Company between one of its cars in Central Park, New York, and the old Terminal Building at Park Avenue and 42nd Street. The distance varied from one and one-half to three miles in the trial from a moving car, while the experiments with the portable field stations showed that this type of apparatus at least would be able to carry on certain communication up to fifty miles, as the field station was able to keep in communication without any trouble with the Metropolitan and Manhattan Life towers and another wireless station at Newark, N. J. Later, communication was maintained between a car on the New Jersey highways near Trenton to the "sparkless" wireless station on the Land Title Building at Philadelphia, nearly thirty miles away.

The receiving station for running automobiles comprised a 7-foot aerial in connection, through a loose coupling, with a variable and a fixed condenser, a detector of the audion type, telephone receivers, and a high and low voltage battery. The sending set comprised two storage cells, a 10-inch spark coil, two Leyden jars, and a 3½-inch "radiotone discharger" similar to those used at the Metropolitan and Manhattan Life stations. This apparatus, which worked successfully up to three miles, the farthest distance tried, would probably operate for several miles farther. The ground was secured by drawing between the rear wheels a bicycle tubing frame supported on four small wheels mounted on roller bearings, the middle space being occupied by three 8-inch steel wheels with slide bearings arranged so as to allow the weight of the wheels to keep them in contact at all times with the road. On the macadamized roads of the park this system of grounding worked fairly well, although on the sandy roads of New Jersey, where the subsequent tests were made, a great deal of difficulty was experienced in properly maintaining the ground. The spraying of water over the contact wheels by means of a small rubber tube leading up into the car partially overcame this trouble, and no doubt subsequent experiments will provide a suitable way of securing a satisfactory ground contact, although it is true that probably for some time to come the speed of moving cars must be considerably limited for successful wireless work. The cars in the tests ran only about ten miles an hour.

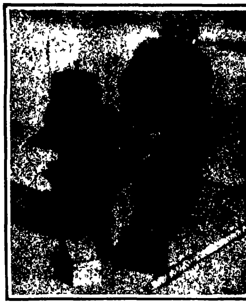
Field stations which can be put up in five minutes can be operated more successfully and the same apparatus used in the automobile by stopping the machine and securing proper ground has a range of about ten miles. The sending circuit of the field stations used in the longer distance tests was the same as that of the moving stations with the exception that three storage cells instead of two were used, and another 10-inch spark coil was connected in parallel with the first coil, so as to be operated from the same key. This gave a range of about fifty miles.

The field sending station was provided with a 100-foot aerial secured at one end to a spreader attached to a 48-foot bamboo telescope mast and leading down diagonally to the top of a 12-foot mast about 90 feet away and thence back to the wireless apparatus about midway between the two poles.

Two of the photographs show the first successful test, in which a 35-foot aerial and a 6-inch spark coil actuated by one storage cell were used. With this apparatus, from Central Park, communication could be held with the laboratory at 42nd Street, about one and one-half to two miles away.

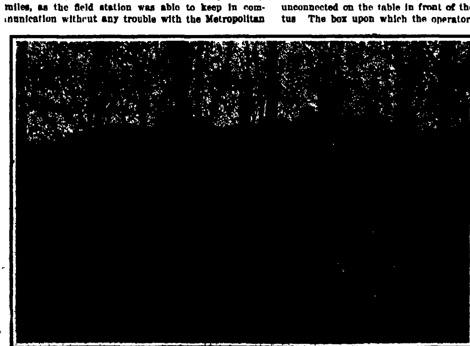
In the more recent tests additional condensers storage cells, and audion receiving accessories were used. The closer view shows a radion detector in use (top of the box to left) while a perikon detector is shown unconnected on the table in front of the other apparatus. The box upon which the operator is sitting contains the interrupter, spark coil, and discharger, which are inclosed on account of their delicate nature and because they have not yet been protected by patent. In the newer station all this apparatus is carried in the automobile, and there is no necessity for setting up the apparatus on the ground although the soap box does indeed make an admirable table for a wireless station.

In the coming tour it is proposed to send two scout cars ahead of the regular contestants, each one of which will carry the complete field set of even greater range than that which every car can carry. Points where the telegraphic facilities are poor or impossible will be picked out and the two cars will arrange to be at stations at these points just ahead of the pilot car, one station being equipped for business while the other is taking care of the telegraphic business of the tour. In this way one of the two field stations will be in operation all the time, while the other is being set up at the next point along the route.

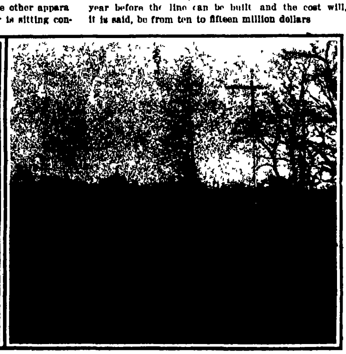


Automobile wireless equipment.

Disastrous as the floods in France have proved for the railways, a worse disaster occurred one day last winter in America. Three days previously a warm wind arose in the State of Nevada so suddenly as to melt all the snow. The result was such a torrent as to entirely wash away 100 miles of the San Pedro, Los Angeles and Salt Lake line south of Caliente. The route of this line was known to be rather liable to this, but was chosen as it saved much distance. Soon after its construction it was undermined by a storm, which did over $500,000 damage to it. The engineers are now engaged in surveying the district in order to find a safer if longer and most costly route. Whichever route be chosen, it will be from six months to a year before the line can be built and the cost will, it is said, be from ten to fifteen million dollars.



The automobile equipment with its aerial and wireless apparatus.



Sending wireless messages from an automobile.

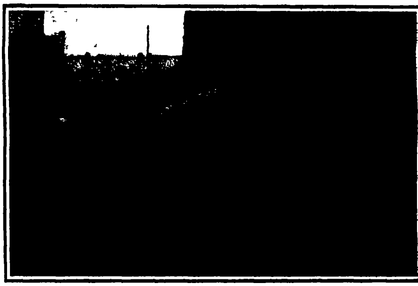
WIRELESS TELEGRAPH APPARATUS FOR CONTESTANTS OF THE GLIDDEN TOUR.

The practical success achieved with the gasoline-propelled motor sleighs on the Shackleton and Charcot polar expeditions has prompted Capt Scott to include a vehicle of this type for his forthcoming dash to the south pole This vehicle is, however, distinctly different from the motor sleighs hitherto used In the two previous cases the front of the car was mounted on runners or skates, a chain and sprocket with spuds which gripped the snow and ice being fitted at the position occupied by the wheels in the ordinary motor car In the new sleigh, however, what may be termed an adaptation of the pedrail or caterpillar system has been resorted to, which imparts a greater degree of efficiency to the vehicle, and enables it to surmount obstacles and to travel over rough ice and snow with ease In view of the conditions prevailing and the work it is intended to fulfill in the south polar regions, the engine is of a special type It comprises four vertical cylinders, cast in pairs, and developing twelve brake horse-power

The sleigh is fitted with a runner, upon which bear the rollers of the chain. The latter passing between this runner and the ground supports the whole vehicle and propels it as the wheels revolve There are no brakes provided, as the big reduction ratio of the worm renders it completely irreversible, so that brakes are not necessary Similarly, steering gear is dispensed with, as such is not requisite, for in any open area such as an ice field steering is not demanded When it is required to deviate to the right or left ropes attached to the front of the frame can perform this function Turning sharp corners, under these circumstances, is admittedly exceedingly difficult, but when working in its designed sphere this drawback will not be serious, as sharp turning can be generally avoided.

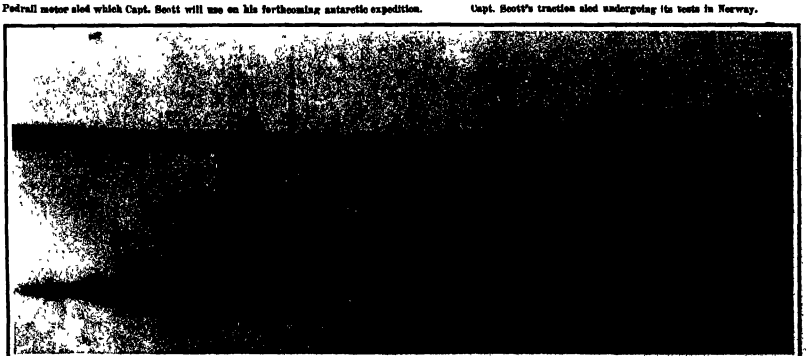
The sleigh has a substantial wooden frame, and underneath is fitted a large undershield extending from end to end so as to present a perfectly smooth surface to the snow When the sleigh is under way a curious fact is observable. The chain, where it

(*Concluded on page 407.*)



Pedrail motor sled which Capt. Scott will use on his forthcoming antarctic expedition.

Capt. Scott's traction sled undergoing its tests in Norway.



A Swedish motor traction sled with a maximum speed of 24 miles an hour.

TWO NOVEL MOTOR SLEDS.

THE FLIGHT FROM LONDON TO MANCHESTER

THE AVIATORS' OWN ACCOUNTS

Both White and Paulhan have furnished the London Daily Mail with accounts of their remarkable flights.

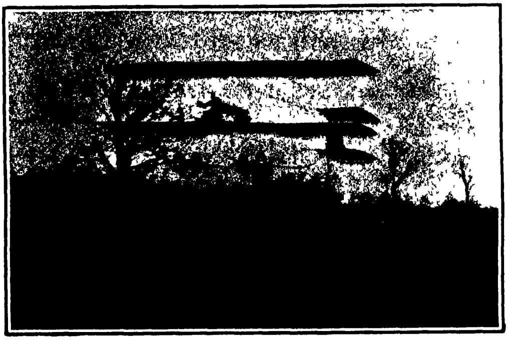
White rose at 2.30 A. M Twenty-four minutes later he was in the air It was so dark that people were groping about with lanterns

"As I stood by the side of my aeroplane," White states, "there was utter blackness facing me, faintly relieved in the distance by two or three twinkling lights, which I knew to be those of Roade station

"My start was a confused jumble of scattering lights, which swept away swiftly below me I could not judge my run along the ground, but I rose as speedily as possible. Directly I was in the air the lights of the railway station showed clearly below me, and I headed toward them I could see absolutely nothing of the ground below me, it was all a black smudge

"I went right over the railway station lights and then, fortunately only for a second or so, my engine missed fire and I began to sink toward the inky darkness below me. I could have picked no landing, and it would have been a swift, steep glide to I know not what And then, to my joy, my engine picked up again and I rose once more.

"Great difficulty presented itself in knowing in the darkness whether I was ascending or not. I had done no night flying before, but I soon became accustomed to watching closely the movements of my elevating plane, which was silhouetted before me against the sky



Grahame White leaving Rugby.

"I steered on for a spell with nothing at all to guide me After leaving the lights of Roade behind, the gleam from an occasional signal box far below helped me, however, and so I picked my way through the night to Blisworth

"Here I felt surer of my ground and bore away to the left for Weedon Faint lights shone here and there Some, no doubt, were cottage windows and others, I think, were the head lights of motor-cars. I passed over Weedon, my eyes becoming more accustomed to the darkness.

White's aeroplane after landing.

"On I flew The weirdness of the sensation can scarcely be described I was alone in the darkness, with the roar of my engine in my ears. As I glanced back small bright flashes of light, the discharge of the exhaust gases from the motor, flashed out in the night

"Then I lost my way, with no railway lights to guide me, for a spell. I steered off to the right. I wheeled and turned, wondering what I should do, but then a light to my left caught my eye, and I worked my way back to the railway line again

"At a little inn by the roadside near the village of Crick a friend had promised to draw up his motor car, shining its headlights upon the wall to act as a guide for me I was keenly on the lookout for this unmistakable light sign, and, sure enough, I saw it quite distinctly below me soon after I left Welton station behind.

"I deviated a little from my course and headed for this patch of light. I saw the motor car moving as I approached, with its headlights throwing a great path of light down the roadway It set off at a breakneck pace, its driver evidently meaning to guide me on my way.

"Leaving the railway line on my left, I followed the light of the motor car, and for a mile or so I hovered almost directly above it, allowing it to act as my pilot. But while I was doing so I chanced to glance over to the left again. Coming down the railway line I espied a goods train. It was making for Rugby.

"This, I thought, will be a splendid guide, and so I swung away from the lights of the motor car and flew off till I was over the train I saw the lights of Rugby, flew over the town, and forged ahead

"Daylight began to come now, and from here on to the point of my descent in a field near Polesworth my struggle was not with the darkness, but with the wind It was the fierce gusts which eventually brought me down."

Paulhan, too, seems to have been troubled by the winds, for he bears out White's account. He writes

"I had to fight the wind all the way from London. Not a moment's rest came to me in my battle against the gusts

"Glance at my altitude chart and you will see that I made rises and dips of as much as 320 feet always with the object of flying in the steadiest level of air I could find

"After the start I was going north for a long time before I sighted the special train which was accompanying me, but there was no mistaking it when it caught me up, with three loud toots of the whistle and a big white signal cloth flowing from the window of the rear coach

"It looked like a handkerchief from such a height but it told me all I could see that things were going well The wind whistled and so did I

"I flew until it was quite dark All I could make out beneath me was the smoke of the train once in a while and the occasional flicker of lights from a village

"I came down rapidly from 300 meters to 100, so that I could be more certain of my direction Then came the most exciting moment of my flight Darkness had fallen and before me I saw the lights of Lichfield I decided to alight in some convenient meadow before reaching the town and to do this I sank down to 150 feet. I was immediately above what looked like a large factory with a chimney I am now told it was a brewery And so, to alight safely in a field with no damage done, I made a fishhook turn, and my machine was now pointing toward London

"Suddenly my motor stopped Every drop of petrol had been exhausted and the machine swooped downward almost like a stone dropping

"What should I do? Beneath me was the brewery

Recharging the gasoline tank of White's machine.

The crowd on Wormwood Scrubbs awaiting White's start.

Paulhan in full flight.

THE FLIGHT FROM LONDON TO MANCHESTER.

and a certain smash, behind me was a narrow field, which was almost like a spider's web with its mesh of telegraph wires

"I had an imperceptible fraction of a second in which to make up my mind, and I decided to risk the telegraph wires As I sank I made a sharp twist right back on the line of my course, and was lucky enough to lift myself over the wires

"I went to bed at 1 o'clock deciding to start again as soon as it was light or even a little earlier I slept like a top for five hours

"It was still dark when I reached the narrow meadow beside the Trent Valley station in which my machine was lying My mechanics had worked well during the night The machine was charged with petrol and she was all ready for the start

Happily, favored with the headwind I was then facing though it was a following wind for my flight, I rose without difficulty, turned, and headed straight for Manchester

"Here was the end of my concern about the issue of the race Barring accidents, I was bound now to reach Manchester in safety and in good time, and there was no reason to anticipate accident, for I had surmounted the worst of the difficulties—that of a rise from a narrow field only 120 yards long above dim lanterns which were my only indications as to the whereabouts of the hedge.

"As soon as I got up I made a circle, followed the railway, and then set off for Crewe, fighting all the way against gusts of wind So certain did I feel of the road that I did not trouble to take my map on the second stage of the journey This was a mistake, for after leaving Crewe I thought the first station marked my landing place, but I could discover none of the marks I expected to find there, and I had to circle back toward London before I picked up the whitewashed marks on sleepers which directed me onward

"I made yet another mistake in my route, and had to curve in yet another circle backward, but at last I saw the new station at Burnage, which was my objective, and I saw the white marks in the field where I was to land

"I landed and I knew I had won All the way from London it had been a fight between me and a puzzling wind, and I had beaten the wind"

Official Meteorological Summary, New York, N. Y., April, 1910.

Atmospheric pressure Highest, 30 28, lowest, 29 57, mean, 29 93 Temperature Highest, 79, date, 30th, lowest 34, date 8th, mean of warmest day, 64, date, 5th, coolest day, 41, date, 8th; mean of maximum for the month, 62 1, mean of minimum, 45 8, absolute mean, 54 0, normal 48 1, daily excess compared with the mean of 40 years, 5 9 Warmest mean temperature of April, 54 in 1871 and 1910, coldest mean 41, in 1874 Absolute maximum and minimum of April for 40 years, 90 and 20 Average daily excess since January 1st 4 1 Precipitation 4 53, greatest in 24 hours, 2 23, dates, 25th and 26th, average for April for 40 years 3.30 Excess above normal 1 23 Accumulated excess since January 1st, 0 14 Greatest precipitation, 7 02 1874, least, 1 00, in 1881 Wind Prevailing direction, northwest, total movement, 9,169 miles; average hourly velocity, 12 7, maximum velocity, 44 miles per hour Weather. Clear days, 7, partly cloudy, 13; cloudy, 10, on which 0 01 or more of precipitation occurred, 11 Mean relative humidity, 68 1 Dense fog, 4th and 18th. Thunderstorms, 6th and 25th. Frosts Light, 14th, heavy, 13th

COMPLETION OF THE PENNSYLVANIA RAILROAD TUNNELS AND TERMINAL STATION.

As late as the year 1901 the Pennsylvania Railroad was employing ferries to land its passengers in New York city just as it did in 1871, when it first leased the United Railroads of New Jersey Ten years ago the system was hauling freight to Eastern cities over practically the same heavy grades as were to be encountered in 1875 To-day the company is completing a monumental improvement in and around New York city which will enable passengers to travel from eastern, western and Long Island points direct into Manhattan Island, arriving at a railroad station which, for convenience and for the beauty and dignity of its architectural appearance, probably outranks any similar building in existence.

During the past ten years the company has spent an enormous sum of money in straightening out its line to the East, and in cutting down grades, and in a few months' time freight trains which are already traveling over the new lines, on which they encounter no grades greater than twelve feet to the mile, will be run direct to large terminal wharves on the New Jersey shore of upper New York Bay, and ferried across to Bay Ridge, Long Island. The company is about to construct a four-track arch bridge across the East River near Hell Gate, and when this is completed trains will be run through Long Island from Bay Ridge to Port Morris, where connections will be made with the New York, New Haven and Hartford Railroad Passengers from the South, Southwest, and West, over the Pennsylvania Railroad system, by using the North River and East River tunnels and the Hell Gate bridge, will be enabled to travel without change of cars between New England and the West by way of New York city These stupendous works, which will have cost in the aggregate, including the revision of the western line, over $150,000,000, were conceived mainly during the administration of the late A. J Cassatt, former president of the company

Commencing at the western end of the New York tunnel system, we find at Harrison, New Jersey, a large terminal and transfer station, where passenger trains from the South and West drop their steam locomotives, and the electric locomotives, which haul them into New York city, are coupled on. The tracks run on a high embankment across the Hackensack meadows to Bergen Hill, where they enter the western portal of the twin tunnels. They descend on a grade of 1.3 per cent to a level about 100 feet below mean high water of the Hudson River, which level is reached about one-third of the distance from the Jersey shore The line then rises on grades of 0 5 and 1 93 per cent until the station yard is reached at Tenth Avenue The yard and the station, which have been excavated to an average depth of fifty feet below the original street surface, extend from Tenth Avenue to Seventh Avenue. From Tenth to Ninth Avenues the yard occupies more than the area of a city block, and from Ninth Avenue to Seventh Avenue the huge excavation covers the whole width between Thirty-first and Thirty-third Streets. The excavation covers therefore over five of the largest city blocks, and it involved the removal of over 3,000,000 cubic yards of material. Proceeding easterly from the terminal yard, the tracks, four in number, are carried below Thirty-second and Thirty-third Streets to the East River, under which they pass in four separate tubes. The grade descending to the river is 1.5 per cent, and the ascending grades to Long Island are 0 7 and 1.22 per cent.

The new terminal station located between Thirty-first and Thirty third Streets, and Seventh and Eighth Avenues, is a truly magnificent structure, built of granite on classical lines The terminal work was carried out under Mr George Gibbs as chief engineer, to whom we are indebted for courtesies during the preparation of the present article The main entrance to the station, on Seventh Avenue, leads through an arcade forty-five feet wide by two hundred and twenty-five feet long, to the main waiting room, which, with its width of 108 feet and length of 277 feet, and clear height of 150 feet, ranks as the largest in the world. Just what these dimensions mean is shown by our front page engraving, which portrays the central portion of the New York City Hall with its tower, standing on the floor of the waiting room, with the top of its flag pole failing to reach the roof by fully ten feet. Opening out from this room are two smaller waiting rooms, each 58 by 100 feet, which are provided with the usual retiring rooms. On the same level also is the main baggage room, 450 feet in length The baggage is brought in, and carried away, through a special subway, the trunks, etc, being delivered to the track below by motor trucks and elevators. Passing through the main waiting room, the traveler will find himself on a vast concourse 210 feet wide, which extends the full width of the station and parallel with the large waiting room. From the concourse, stairs lead down to the train platforms on the track level below, which is forty feet below the street surface The concourse, which is 340 feet long, is covered by a lofty roof of light steel columns and arches and glass. Between the concourse and the tracks is a sub-concourse, sixty feet in width, which will be used for outgoing passengers only

The Thirty-third Street side of the station will be devoted to the Long Island Railroad service. It will be provided with its own entrances and exits, and the traffic will be handled independently of the western traffic.

In the design of the exterior of the station, the architects, McKim, Mead & White, endeavored to give to the building the character of a monumental entrance to the commercial metropolis of the country, which would at the same time conform to the traditional aspect of a great railway terminal. Also the station was designed to give as free a circulation as possible for the many millions that will annually pass through it. The main façade on Seventh Avenue is

composed of a Roman Doric colonnade, with columns four feet six inches in diameter and thirty-five feet high. Allowing for its much greater scale, the main entrance is comparable to the Brandenburg gate in Berlin. The main body of the building is about the same height as the Bourse of Paris, reaching, as it does, seventy-six feet above the street level. The main entrance on Thirty-second Street is at the center of this façade, and at each corner is a sixty-three-foot wide carriage drive, fronted by double columns and pediments. Midway along the Thirty-first and Thirty-third Street sides of the building are similar columns and entrances to that on Seventh Avenue.

The passenger station building, which is 784 feet long by 430 feet wide, covers some eight acres of ground, and the construction of the exterior walls, which are nearly half a mile in length, required nearly half a million cubic yards of pink granite. This and other stone work in the building ran up to a total of 47,000 tons, and to transport it from Milford, Mass., called for the service of 1,140 freights cars. Into the construction of the building there has also entered 27,000 tons of steel and 48,000 tons of brick.

The statistics of dimensions and quantities of material are of such interest that we present the following from among those supplied by the railway company:

Area (10th Avenue to normal tunnel section east of 7th Avenue)	28 acres
Length of trackage	16 miles
Number of standing tracks at station	21
Number of passenger platforms	11
Total excavation required	3,000,000 cubic yards
Length of retaining walls	7,500 feet
Number of lineal feet of streets and avenues carried on bridging	4 400, or an area of about 8 acres.
Concrete required for retaining walls, foundations, street bridging and substructures	160,000 cubic yards
Number of columns supporting station building	650
Greatest weight on one column	1,658 tons
Number of buildings removed on terminal area, about	500
Boiler capacity of service power plant ultimate	5,000 horse power
Total length of tunnel (2-track), Jersey to Long Island	5.3 miles

After passing under the East River the four tubes reach Sunnyside Yard, the terminus of the Long Island tunnel extension, which covers some 153 acres of land. It contains 73 miles of track, and has a capacity of 1,550 cars. From the Sunnyside yard there are tracks leading to the New York connecting railroad, which will form a junction with the New Haven Railroad at Port Morris.

An important feature of the New York tunnel extension is its relation to the Long Island Railroad, which is subsidiary to the Pennsylvania system. It is estimated that forty minutes will be saved between Long Island points and New York city by the operation of trains through the East River tunnels to the Pennsylvania station at Thirty-third Street.

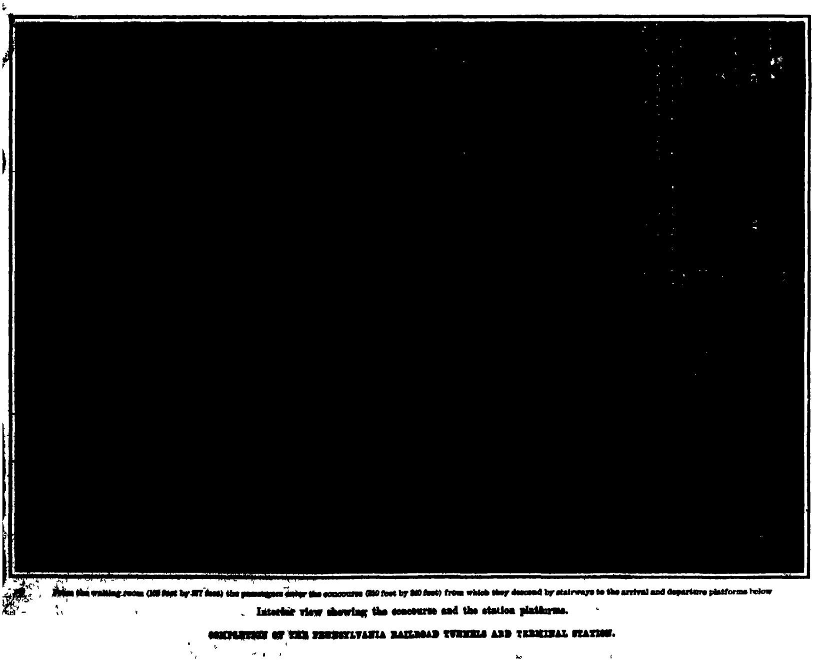
The construction of the tubes beneath the Hudson and the East rivers has been so fully described in previous issues that it will be sufficient here merely to recapitulate the principal features of this work. The tubes under the Hudson River were driven by a special shield designed by Charles M. Jacobs, who is also well known as the chief engineer of the four Hudson River tubes which were simultaneously being driven for the Hudson Company's system of rapid transit tunnels. Contract for the North River tunnels was let to the O'Rourke Engineering and Construction Company. The shields were thrust forward by twenty four rams capable of exerting a pressure of 3,400 tons. At first, the silt and other material were removed through the doors in the front of the shield, latterly, however, the shields were pushed bodily through the material, and only about one-third of it was removed through the tunnel, being admitted through the doors in its lower face. The cast-iron lining of the tunnel is twenty-three feet interior diameter. The interior is lined with two feet of concrete making the finished interior diameter of the tunnel nineteen feet. The weight of the cast iron lining, with bolts, is from 9,609 to 12,127 pounds per linear foot of tunnel. The weight of the finished tunnel with the heavier lining, when concreted up and equipped, is 31,469 pounds per lineal foot. The weight of the silt displaced, per linear foot of tunnel, is 41,548 pounds. The weight of the tunnel with the maximum train load is 41,869 pounds per linear foot.

Thanks to the very able and efficient engineering staff, the excellence of the contractors' equipment, and the harmony with which all concerned entered into the task of driving these tunnels, the work was carried through practically without a hitch, and considerably faster than the most sanguine expectations.

The driving of the tunnels beneath the East River, which was in charge of Alfred Noble, Past President of the American Society of Civil Engineers, was done by S. Pearson & Son, the contractors, of London. Because of the great variety and difficult nature of the material through which the tubes passed, much trouble was experienced at various times with blowouts, but ultimately these difficulties were mastered and the tubes pushed through to successful completion.

In addition to the many millions the Pennsylvania Railroad is spending on the four tunnels under the East River, and the station and terminal in Manhattan, all of which will greatly benefit Long Island, the Long Island Railroad is increasing its own facilities in all directions, so as to adequately care for the larger traffic which will result from the completion of the tunnels. The contemplated works will necessitate an expenditure on the Long Island system of more than thirty million dollars. The new service will include a six track line from the mouth of the tunnels to Woodside 2½ miles, one mile of 8-track road, Woodside to Winfield, two miles of 6-track road, Winfield to Glendale cut-off, and 4½ miles of 4-track road thence to Jamaica. Trains will run from Thirty-third Street, Manhattan, to Jamaica in 18 minutes, to Garden City in 34 minutes, to Mineola in 34 minutes; to Far Rockaway in 33 minutes, to Flushing in 16 minutes, and to Great Neck in 26 minutes.

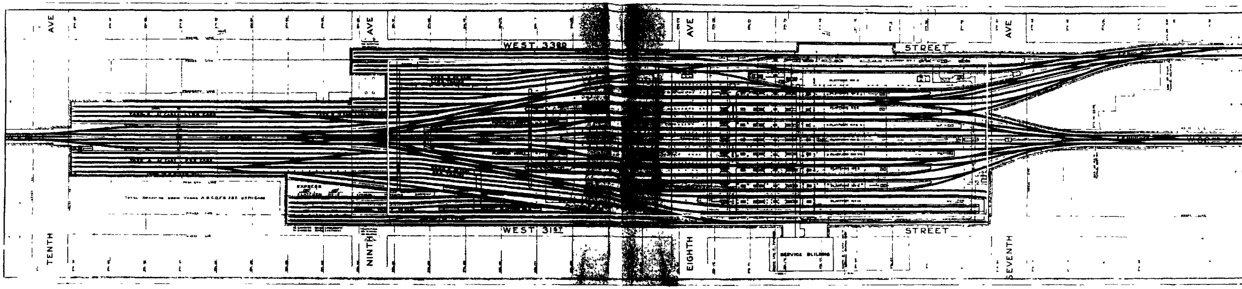
We will close by giving some of the startling statistics of population which in the judgment of the Pennsylvania Railroad Company fully warranted the enormous outlay involved in the great works which the company has undertaken. The population included within a circle of nineteen miles drawn from the City Hall in Manhattan as a center, was in 1890 3,326,998, in 1900 it had increased to 4,612 153 and in 1905 it had grown to 5 404,638. It is estimated that by 1913 the population of this territory will be about 6,000,000 people, and in 1920, 8,000,000. The railroads that have their termini on the western bank of the Hudson River carried nearly 59,000 000 people in 1886. In 1890 they carried over 72 000,000, in 1896 more than 94,000,000, and in 1906 they carried about 140 000,000 people. The significance of these figures was fully considered by the Pennsylvania Railroad, and the vast works they have undertaken are thought to be fully justified by the present and prospective growth of travel within the areas affected.



From the waiting room (105 feet by 277 feet) the passengers enter the concourse (340 feet by 210 feet) from which they descend by stairways to the arrival and departure platforms below.

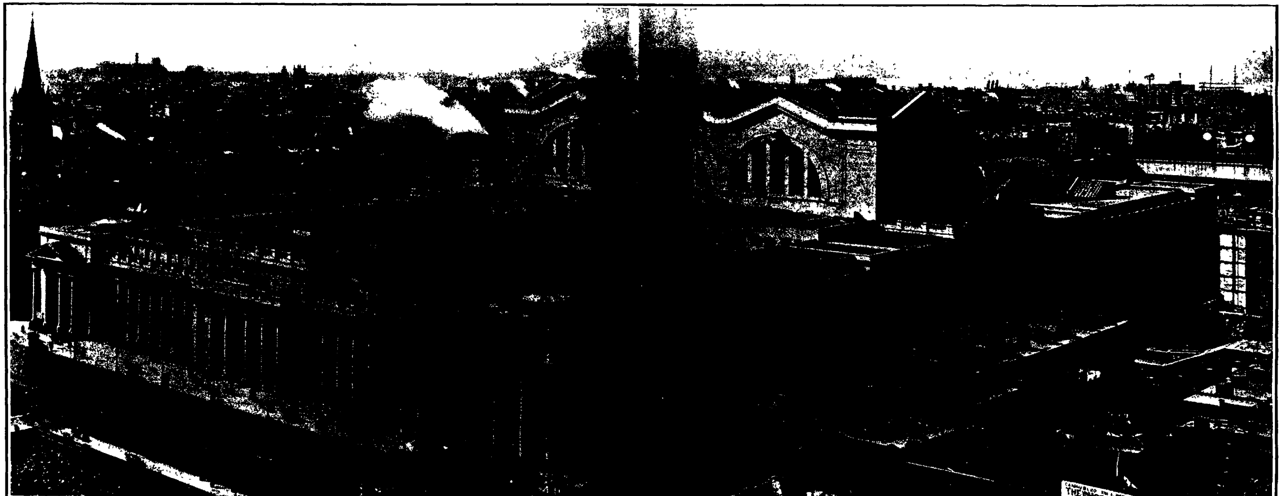
Interior view showing the concourse and the station platforms.

COMPLETION OF THE PENNSYLVANIA RAILROAD TUNNELS AND TERMINAL STATION.



The whole of this area, which includes over five [illegible] city blocks, was first cleared of 500 city houses and then excavated to an average depth of 40 feet below street level. The easterly half, between Seventh and Eighth Avenues, is covered by the station building. The whole yard contains 28 acres and 16 miles of track. There are 21 standing tracks and 11 platforms. The yard has also storage capacity for [illegible] cars.

PLAN OF THE HUGE SUB-SURFACE STATION YARD OF THE PENNSYLVANIA TERMINAL, MANHATTAN ISLAND



This stupendous structure, the largest of its kind in existence, covers an excavation out of which the engineers blasted some 3,000,000 cubic yards of rock. This portion of the terminal, whose floor is 40 feet below the street, contains the 21 tracks and platforms, and into it open the tunnels from New Jersey and Long Island. The superstructure, or that portion seen in this engraving, contains the waiting rooms, restaurant, [illegible] rooms, and the general offices of the railroad. The frontage is 430 feet on the avenues and 784 feet on the streets.

BIRD'S-EYE VIEW OF THE SUPERB STEEL AND GRANITE TERMINAL STATION OF THE PENNSYLVANIA RAILROAD ON MANHATTAN ISLAND

Handy Man's Workshop

HOW TO BUILD A HOUSEBOAT FOR $300.

BY FREDERICK E. LORD

The proposition of spending a summer afloat is one which appeals to many persons fond of the water, but the cost of a yacht large enough to accommodate comfortably a family for a protracted period is prohibitive to the majority, therefore people swelter ashore in hot and uncomfortable hotels, and snatch such enjoyment from the water as chance and circumstances permit

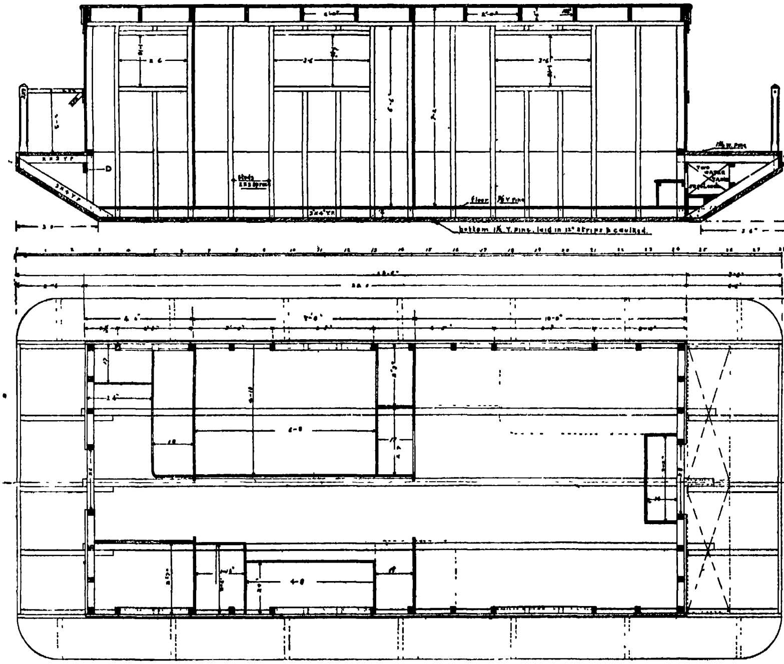
during the summer season under equally comfortable conditions. The cost of the boat would vary, according to whether it was built by amateurs and how elaborately it was constructed and fitted up A moderate price shipbuilder should build this boat complete with toilet and water tanks for five hundred dollars. As the boat is very simple in construction amateurs should be able to build it for about three hundred dollars. At a small additional cost an awning could be rigged over the house-top, thereby providing a fine, large, cool lounging space.

For those interested in building such a boat themselves the following hints on construction may prove useful

The first step in construction is to prepare the ground and build the sides and bottom of the hull The ground should be prepared by driving posts and using stringers and blocks so placed that the hull may rest during construction on an absolutely level plane By doing this a level and plumb line can be used to get the house and its compartments built plumb and true After the building foundation is prepared, start by

so that they touch on the inside and are open about ⅛ inch outside. This is to allow the caulking to be driven in and to prevent its being pushed clear through to the inside. In putting the hull together use large galvanized iron boat nails about 4 or 4½ inches long. The corner log, *A*, should be fastened to the sides with ¼ inch galvanized iron rivets, and the bottom planking should be fastened to both log and sides. Be careful that the planking lies perfectly flat and true before fastening, otherwise leaks will surely develop, which are hard to stop. Paint should be applied and a few threads of cotton laid along the edge of the sides to help make a water-tight job. After the bottom is on three 3 x 4-inch yellow pine stringers, *C*, should be fitted and nailed from the underside of the bottom. Carry these stringers up to the ends as shown in the plans. This gives us the bare hull, and we can now proceed with the house frame and small decks at each end

It might be well first to call attention to the two water tanks that are shown in the drawing. If these are to be put in it is well to do it now, otherwise some



SECTIONAL PLAN AND SIDE VIEWS SHOWING CONSTRUCTIONAL DETAILS OF THE HOUSEBOAT.

A solution of the problem of living cheaply and comfortably afloat is found in the houseboat Such a life offers many charms and advantages It is generally cooler on the water, and the air is fresher and better being free from dust and land smells. Bathing is always "on tap," and the entertainment of friends is accompanied with more charm and privacy than in a crowded summer hotel If the locality becomes tiresome the houseboat can be towed to another harbor for a few dollars and there is no packing of trunks or tipping of servants when getting out of town.

The plans herewith shown represent a small houseboat capable of accommodating four or five persons comfortably for a very moderate price It would cost four persons fifty dollars a week at an average-priced summer hotel This amounts to six hundred dollars for three months, without extras. The boat shown here could be built for less than that Then at the end of summer it could easily be sold for more than half its value or kept for another year In any case there would be a very large saving over living ashore

getting out the sides. These are of 1½ inch yellow pine, laid three strakes to a side As the depth of the hull is 30 inches the sum of the three planks should be 28¼ inches to allow for the thickness of the bottom. The sides are held together by temporary strips of wood screwed to them. When thus secured fasten on the lower inside edges a yellow pine corner log 3 x 4 inches as shown in the cross section plan at *A* The object of this is to stiffen the edge and afford extra nailing surface for the bottom planks Now set up the sides in their proper places on the building foundation and be very careful to see that they are perfectly plumb and level, otherwise the whole structure will be crooked. Nail three or four strips across the bottom to hold it in place and then put in the end pieces *B* of the hull. These are of 1½-inch yellow pine Next put on the planks which extend from the end pieces to the bottom These planks, as well as the bottom ones, are of 1½ yellow pine, and about 12 inches in width. Proceed to put on the bottom by beginning at both ends and working toward the middle. Plane the planks

of the deck beams and deck cannot be laid, and it is more trouble to put them in later They should be of 1-16-inch galvanized iron and fitted with filling plates to come flush with the outside of the deck. The supply pipes can be run under the cabin flooring before it is put down.

The next members to put up are the stud beams to take the weather boarding of the house. The beams are of 2 x 3-inch spruce. They should be cut into lengths of 6 feet 11 inches. Jog them over the corner log, *A*, and securely nail them to it. Fasten them to the side of the hull with stout galvanized iron nails, care being taken to get several very good fastenings in the lower side plank. The spacing of these beams will vary on account of the positions of the windows and partitions. The way to do this is to put up, first, all the beams that come at window openings and partitions and then space up equally the intervening beams. The construction plan shows the dimensions and position of the beams. A sill, *C*, of 2 x 3-inch spruce, is now laid on top of the beams and fastened thereto

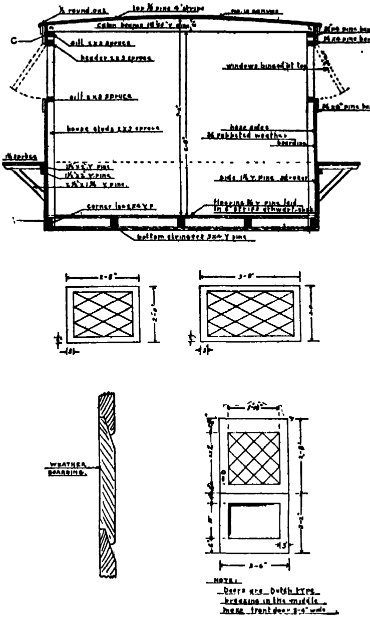
securely Put in the headers and sills for the windows and the studs immediately under them.

Proceed to finish the decks. Run 1½ x 3-inch yellow pine stringers across the end studs 4¼ inches below where the top of the deck will come. Use 3 x 3-inch yellow pine deck beams, seven to a deck, including sides, and securely nail to the stringer and end board of the hull. A deck of 1¼-inch white pine may then be laid in about 10-inch widths or less, and after being well painted covered with No 10 canvas. As the run boards on either side of the hull will serve conveniently as a staging for building, it may be well to put them on. The boards themselves are of 1¼-inch spruce planks fastened to 1½ x 2 yellow pine cleats spaced seven to a side, as shown in the plans. They are supported by 1¾ x 2½ yellow pine braces, securely fastened to the hull and jogged into the cleats.

The roof beams should next be put up. These are of 1¼-inch spruce, 6 inches deep at center and 3 inches over sills. This gives a crown of 3 inches, just enough to shed water The beams are spaced 2 feet on centers except where it may be necessary to vary them slightly so that they may serve as a backing for the partitions.

It is now in order to board up the sides. Use ⅞ x 6-inch rabbeted boards of the type shown in the section Start from the bottom and lay out the widths, as shown in the plan, so that they will come right for the finishing bands. Nail each board to every stud with two nails, and countersink and putty the heads The sides are now ready for the finishing bands and window trim' Commencing at the corners put on the vertical trim of ⅞ inch white pine 6 inches wide, and also the door trim Then the horizontal band under the windows and the strake at the upper edge of cabin, which should be 8 inches deep and finally the second band at cabin top and the window trim, both 4 inches wide All the foregoing should be of ⅞-inch white pine The trim at the window openings should be set back so that a shoulder is created by the studs and sills to form a rabbot for the window The cross section plan will show this The windows are hinged from the top and swung outward, as indicated.

Proceed to finish up the cabin roof by planking it over with ⅞ inch white pine boards laid in 4-inch widths and having a tongue and groove with a beaded edge underneath for a finish in the cabin Paint the top well and cover with No 10 canvas laid in a single piece It can be obtained in widths as high as 12 feet, and it is much better to use the single piece and get rid of seams which are liable to leak. Draw the canvas over the edge of the house, and after securely fastening with copper tacks cover them up with a half round molding, as shown in the plan. The doors and windows should be 1¾ inches thick, and these plans will be sufficient to enable any one to get them out The doors are of the Dutch type that is, they open in two sections They are more handy and convenient when thus made.

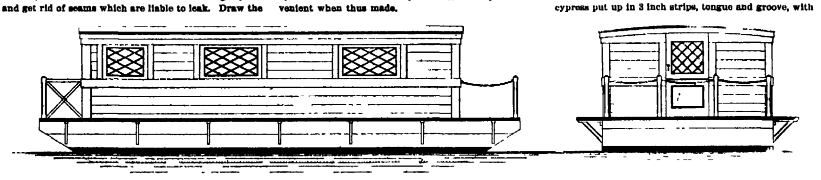


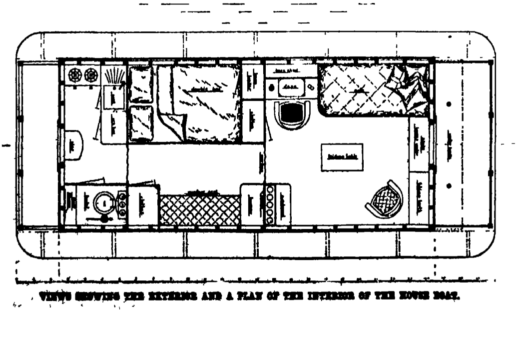
CROSS SECTION OF THE BOAT AND DETAILS OF THE DOORS AND WINDOWS.

An ornamental railing fore and aft, as shown, affords safety and convenience. The after side is fitted with a rope, which can be unhooked to allow boarding the craft. This completes the hull, and we can now turn our attention to the interior

The first step is to lay the cabin flooring after painting the inside of the bottom The floor may be of ⅞-inch yellow pine, laid either in 6-inch widths or in narrower widths, with tongue and groove The former width is perhaps preferable in this case Begin at one end and plank athwartship on the stringers and corner logs. Sweep out all shavings and sawdust as you proceed After the floor is laid and smoothed up, the partitions and cabin fittings are ready to go in

The interior is arranged to provide sleeping accommodation for a mixed company of four Entering the houseboat from the after end the first compartment comprises the living room, which is turned into a sleeping room for the men at night. The doorstep has a removable tread, and is used as a locker On the right a 6½ x 3 foot couch is installed, fitted with a spring and mattress. Next to this is a desk with bookshelves above Upon the opposite side, near the door is a folding berth, shown standing on end This is built simply like a hollow box, containing an ordinary spring and mattress. It is lowered down for use and afterward up-ended and held by a couple of hooks In the opposite corner is a sideboard with glass rack above and drawers beneath to hold table linen A folding table and two or three easy chairs complete the furniture in this compartment. Of course chairs and couch should be bought, but it would be more satisfactory to make the desk sideboard and table, and this would not be very difficult if it was done simply of oak, in the mission style, and stained The next compartment is for the ladies Here a double bed is shown which may be taken from the house and installed or built in like a regular bunk with drawers underneath or left open for the reception of trunks There are two lockers at the foot, one for linen and the other opening into the sitting rooms for the men's clothes A built-in bureau is shown opposite and a window seat and clothes closet The forward compartment contains the toilet with mirror and folding wash basin on the left and the galley fittings on the right An alcohol stove is indicated along with a porcelain sink and ice-box under the dresser Stores may be carried under the forward deck The partition for the cabin divisions and lockers should be of ⅞ inch cypress put up in 3 inch strips, tongue and groove, with a V or beaded edge White paint may be used but a very nice effect is had by staining the partitions and stud beams dark green and filling in between with green burlap tacked in place and finished around the corners with a neat little molding The roof and house beams should be either white or a very light olive gray green Varnish the floor and use rugs or mats Of course the cabin sides may be ceiled over but that adds somewhat to the expense and admits of a less artistic effect A very good looking finish for the exterior is as follows After calking the bottom planks with oakum putty the seams and then give the bottom three coats of red antifouling paint Carry this up the sides for 10 inches Paint the rest of the hull black A very dark red for the weather boarding looks well Make all the bands, window trims and sash and deck railings white The decks and cabin top should have four coats of a buff color All other wood should have three coats.





VIEWS SHOWING THE EXTERIOR AND A PLAN OF THE INTERIOR OF THE HOUSE BOAT.

The boat is moored by securing chains on either side of the hull and leading them to a common chain about 15 feet ahead of the boat Use three times as much chain as there is depth of water and a 300-pound mush room anchor, and there need be no fear of going ashore

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

COAT AND PANTS HANGER.—S. OICHMAN, New York, N. Y. This hanger is adapted to support in a smooth well formed manner the coat and either the pants or skirt of a suit of clothes. It has a supporting bar and a clamping bar co-operating with the bar, the latter being adjustably secured at one end and removably secured at its other end.

Of Interest to Farmers.

CATTLE-GUARD.—L. T. COX, Columbia, Tenn. This invention relates to a type of cattle guards arranged on cross ties of a railroad and having yielding obstructions mounted upon the ties that hinder the free passage of cattle over the guard, and has for its object to provide a guard that is effective in service, and greatly obstruct a traverse of the guard by live stock, without injury thereto.

Of General Interest.

BRISTLE RIM FOR ROTARY BRUSHES.—I. ABRAHAMSON, Friburg, Breisgau, Germany. The improvements in rims consist in making the disks of sheet metal and in providing them with projections pressed out of their material which projections engage in the bristles and thus take hold of them, whereby, even when the brush rotates at high speed, any loosening of the wire as well as any shifting of bristles on the circumference of the disks is prevented. Then it is possible to use the brush until the bristles project only a few millimeters beyond the holding disks.

CARTRIDGE.—C. O. PEARSON, Banning, Cal. The cartridge is for use in cylinder bore shot guns and like firearms, and arranged to increase the carrying capacity and to predetermine the scattering of the shot at any distance. For this the shot is held in a container capable of separation from the cartridge casing on firing the explosive charge, the container being provided with means for retaining the shot during a portion of its flight and for turning the container over to allow the shot to scatter.

SHAVING CUP.—J. PATRONAGGIO, New York, N. Y. This cup has a receptacle at one side and a soap holder at the other side disposed above the plane of the bottom of the soap holder with which the soap is adapted to engage to hold the soap in place when the barber is making a lather by moving a shaving brush across or around the soap.

DENTIMETER.—A. D. CLOUD, New York, N. Y. The purpose here is to provide a device in which the ends of the gage wire may be readily applied and detached. This is done by constructing the instrument with a head at its inner end having slots in the edges at opposite sides. The ends of the wire are passed into these slots and said ends each given a turn or two about the shank of the tool preparatory to twisting the wire loop to the tooth.

WATER METER.—J. H. CONNELL, Charleston, W. Va. In operation water enters by a throttle valve passes into the valve chamber through an opening which is uncovered into the casing body. Force of water swings a vane until it engages and shifts a shifting bar. This swings a plate and a valve moves to cover the discharge opening. Means provide for the water to flow into the casing until it shifts the bar. The pin and slot connection between the bar and plate permits some lost motion between parts while the box spring retains the plate in swing position, and insures it a clear swing across the chamber to move a block to close and retain closed an opening.

TIGHTENER FOR DRUMHEADS.—E. M. YARKS, Norman, Okla. Among the principal objects in view in this case are to provide means for quickly tightening the heads of drums, to provide means for adjusting the tightening devices individually and for operating the same collectively, and to provide a strong, simple and efficient construction for drum bodies and head tighteners.

BABY HAMMOCK.—W. H. CONNERY, Chattanooga, Tenn. This hammock may be hung from the sides of a sleeping room above the bed of the mother or out of doors on a porch or lawn, and is so arranged as to permit ready access to the occupant. One object is to readily adjust it to any height relative to its support by an improved means.

ROASTER FOR ORES.—A. J. GARVER, Clarkston, Wash. In this case the invention relates to roasters for use for ores, the more particular purpose being to produce a simple type of roaster in which the ore while heated is brought into minute contact with the air so as to completely desulfurize the ore and otherwise prepare it within a short time for smelting.

PIANO TOUCH REGULATOR.—W. S. THOMPSON and C. W. BAIR, Fort Collins, Colo. It is well known that pianos are constructed for light and for heavy touch performers. The aim of the present invention is to provide a means for regulating the touch of the action, that is the resistance of the keys to the touch of the performer, and wherein the said resistance may be increased or decreased to suit the individual.

DISPLAY FIXTURE.—W. E. TAYLOR, St. Louis, Mo. This fixture is more especially designed for advantageously displaying wall papers and the like and arranged to accommodate a number of wall papers in proper position for view and selection by a customer, and to permit of conveniently removing any one of the displayed wall papers and replacing the same by another.

VENTILATING SCREEN FOR DOORS.—I. B. SEELEY, Chicago, Ill. This improvement relates more particularly to a device comprising a screen body adapted to be movably mounted near the door, intermediate the top and bottom thereof, and to attach removably to the door when the same is partly closed, so that the ventilating openings are left at the upper and lower portions of the door way.

SIGN.—F. S. SCHAEFER and W. D. NASCH, North Yakima, Wash. This invention is an improvement in advertising signs, and has in view a sign in which the letters or other symbols on display are illuminated in either artificial or natural light, the symbols in either case presenting clear-cut reflecting surfaces in any ordinarily lighted place.

LOOSE LEAF BINDER.—T. BRAZIL-DINNEN, Milson's Point, North Sydney, New South Wales, Australia. The invention embodies a box case of two telescoping sections, screws for moving the two sections to and from each other to clamp and release the leaves, and an operating shaft operatively connected to the screws, each screw being incased in telescoping thimbles respectively carried by the opposite sides of the case, and arranged to be received in notches formed on the edges of the leaves when the latter are inserted in binding position between the plates.

DREDGING-SCOOP.—T. S. HARWIS, Vancouver, British Columbia, Canada. The intention in this instance primarily is the provision of a scoop essentially consisting of two opposed scoop members having a pivotal movement to and from each other, and which are operable to effectively claw or dig up the material preparatory to gathering it in.

Hardware and Tools.

SEAL-LOCK.—A. A. DE A. DECASTRO, Sao Paulo, Brazil. The lock can be used with advantage for a safe, and where effective locking means is desired, but is more especially designed to be used with money remitting pouches, mail bags or anything in fact which requires a lock that cannot be tampered with without leaving clear proof of such molestation behind.

ATTACHMENT FOR REPAIR TOOLS.—W. L. DINSMOOR, Longbeach, Cal. This invention provides a heating plate for vulcanizing purposes, interchangeable with the upper or movable clamping plate on the tool. To this end the plate is preferably cast with an inner passage and has one or more burners on its outer face communicating with the passages, shields over the burners for reflecting the heat to the plate, and a lug for the reception of the clamping screw which operates to force the two jaws or clamping plates together.

Heating and Lighting.

VAPOR BURNER.—E. B. RAYMOND, Los Angeles, Cal. The invention relates to burners adapted for the combustion of coal oil and its distillates for the generation of heat, and has for its object to provide details of construction for a burner that render it capable of vaporizing and consuming heavy coal oil, without smoking or depositing of residuum in the burner.

ELECTRIC LAMP SOCKET.—V. T. DAILEY, New York, N. Y. The present invention has in view to construct and apply a cover in a manner such that the socket ring may be revolved on the socket shell to carry the caps from over the posts and expose the binding screws, thus avoiding the necessity of entirely removing the cover from the base for this purpose.

PORTABLE ACETYLENE-GAS GENERATOR.—O. A. LOVELESS, Watersmeet, Mich. The invention embodies an outer water tank, an inner carbid tank and a cover common to both removably applied, the former having bowed springs supporting the latter, having a central stem adjustably connected to the cover and provided with an enlarged pocketed portion at its lower end through which water from the water tank percolates into the carbid tank, and the cover having a conical screen for straining the gas as it leaves the generator, with the screen pointing outwardly.

Household Utilities.

ADJUSTABLE IRONING BOARD.—J. G. KIRKPATRICK, Prescott, Ariz. In its construction the device includes a leg which rests upon the floor, and an object of the inventor is to provide means for rigidly bracing the board upon this leg, and further to provide improved means for adjusting the board to varying heights or thicknesses of the table edge.

CLOSET-SEAT.—T. G. PHILPOT, Augusta, Ga. This invention is an improvement in water-closet seats of wood. In a seat of this class it provides means for preventing the splitting of the side sections across their deflected ends and this is accomplished in the present instance by means of lugs extending from the ends of the front and rear sections.

REFLECTOR-STOVE.—J. T. REESOR, Mercer, Pa. Mr. Reesor's invention pertains to reflector stoves, his more particular purpose being to provide a stove to be heated by gas, vapor, or other combustible aeriform body, the construction being such that the heat when produced is distributed advantageously and diffused as nearly equally as possible.

Machines and Mechanical Devices.

PERFUME-VENDING MACHINE.—A. F. VOSCH, Bensonia, Mich. This machine comprises a bulb presser for the atomizer, with check-controlled means to lock the presser against retraction in its advanced movement, automatically released as the bulb is pressed, and to lock the presser against advanced movement in its retraction, whereby the presser cannot be withdrawn until the advance movement is completed, nor be advanced after being partially retracted, which prevents the operator receiving but one spray for each check or coin.

INDICATOR.—W. D. STANTON, New York, N. Y. The object here is to provide a machine so constructed that the values thereon can be viewed from different directions when the indicator is projected into a transparent part of the register casing, and in which each indicator consists of a plurality of telescopically arranged units, thereby conserving space and reducing the size of the machine.

COMPRESSOR.—J. D. MAYHEW, Tyler, Texas. This compressor is employed in connection with ammonia, ice or refrigerating machines that compress the gas from the coils into the condenser. One object is to produce means whereby the maximum amount of gas or vapor may be compressed. Further to provide a compressor in which the heat evolved during operation of compressing gas or vapor may be utilized to dry the incoming gas.

WELL-DIGGING APPARATUS.—M. LATTA, Valentine, Neb. In the present patent Mr. Latta provides a settling chamber, and a pumping mechanism by which to exert a constant suction in the settling chamber and a suction pipe discharging to the settling chamber, and to this extent in a broad way the present invention is similar to the apparatus shown and claimed in a former patent granted to this inventor.

RUDDER.—S. B. MCNEELY, Natchez, Miss. More particularly the invention relates to a rudder which is normally inoperatively disposed in a well carried in the hull of the vessel and located near the bow, suitable means being provided for projecting the rudder into an operative position and for turning it to steer the vessel in one direction or the other.

MEAT-SLICER.—A. W. JOHNSON, New Brunswick, N. J. This improvement refers to slicers such as used for making slices from roast beef, corned beef, and similar meats. In its general construction the device presents a cradle upon which the cut of meat rests, and the frame of the device supports a knife toward which the meat is automatically advanced by the operation of the knife.

MATRIX FOR LINOTYPE MACHINES.—C. W. GRASSICK, Berlin, Germany. The invention relates to an improvement in matrices, whereby many defects are avoided. It consists in reducing the contact surfaces of the side portions to middle parts, which extend over the intaglio letters. Thereby the risk of imperfect fitting of the middle parts of the composed matrices is reduced and a more perfect lock up of the composed lines is assured.

APPARATUS FOR PREPARING MATRIX SHEETS FOR THE REPRODUCTION OF WRITTEN MUSIC OR THE LIKE.—F. DOUIBERT, 18 Rue Oberkampf, Paris, France. This machine is for use in printing suitable surfaces by means of suitable characters or type, but it is more particularly suitable for the preparation of matrix sheets intended for use in the reproduction of written music. It is electrically operated and is provided with a controlling arrangement by which regularity in the action exercised by the type on the surface to be printed upon or stamped, is obtained automatically.

Prime Movers and Their Accessories.

OILING SYSTEM FOR ENGINES.—G. W. FAIRFIELD, of the U. S. Navy. In the present patent the invention has reference to oiling systems for engines, and the object of the improvement is the provision of means for use in automatically oiling the wrist pin and crank pin bearings of an engine. The oil is provided in a continuous circulation.

INTERNAL-COMBUSTION ENGINE.—O. E. FREAR, Albany, N. Y. Means provide in this case for controlling the inlet and exhaust ports of four-cycle engines by fluid pressure. Both the inlet and the exhaust valves connect with auxiliary pistons mounted in auxiliary cylinders. Means are provided to open the inlet valve which remains open during the suction stroke. No cams, rock shafts, levers or mechanism operate valves from crank shaft or any other moving part of the engine. Gas pressure is utilized as sole means for operating all the valves.

HYDRAULIC-POWER PIPE SYSTEM.—C. A. COMPTON, Washington, D. C. The main object here is to provide a means by which a stream of falling water may be partially deflected in an upward direction and may be again brought into contact with the descending stream, thereby imparting to the latter increased pressure. Further, to provide a means for accomplishing the above which may be applied to any power plant having a turbine shaft and a turbine located at the bottom thereof.

Pertaining to Recreation.

COMBINED HOBBY-HORSE AND VEHICLE.—F. W. FUNSART, Hicksville, N. Y. More particularly the invention relates to a form of vehicle or cart combined with a hobby horse, so that the person riding on the vehicle will be seated on the horse. By means of certain features, the device may serve all of the functions of an ordinary rocking-horse, or may serve the functions of a cart or ordinary vehicle, or all of the advantages of both may be combined in one.

COUNTER-HOLDER.—C. H. RAMBY, Courtenay, N. D. The intention here is to provide a holder for pool and like counters, in which the number of counters remaining in the holder can at all times be easily determined, in which the counters cannot be identified, which serves as a substitute for the ordinary "bottle" commonly used to contain pool counters, and which obviates the occurrence of certain mistakes in the use of the counters.

PUZZLE.—D. E. SMITH, Mount Vernon, N. Y. The idea in this case is to produce a means of affording amusement and interest in attempts at solving a puzzle. The invention relates to that type of puzzles which includes a ring which is apparently attached to other pieces so that it cannot be removed, but the construction is such as to enable the ring to be removed by the exercise of ingenuity, and the manipulation of the parts.

Pertaining to Vehicles.

LOG-RETAINER.—W. DRAVES and C. KELLAHER, Tomahawk, Wis. The device embodies a sill having a strap passing around each end from one side of the sill to the other, each strap having at one side of sill a dog pivoted to swing from below the upper face of the sill to upright position, and at the other side a chain latch for securing the holding chain of the opposite dog, with further means, whereby the dog at one side of the car or vehicle is locked and released at the opposite side of the car.

VULCANIZING IRON.—W. L. DINSMOOR, Longbeach, Cal. This iron is to be heated by acetylene gas from the acetylene lamp generator, and is provided with a flat and concave vulcanizing face with one or more intermediate combustion chambers, the flat vulcanizing face serving to apply the patch to inner tubes, and the concave vulcanizing face serving in a like capacity for outer tubes while the latter remain in place on the motor vehicle wheel.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 18th, 1909, or will be sent by mail on request.

(12221) E. S. L. asks: Have you a SUPPLEMENT or other paper that will give me a plain explanation of the principle of the radiometer? A. The explanation of the rotation of the radiometer is given in Barker's 'Physics,' page 395, in Carhart's "High School Physics, page 203, in Hoadley's 'Elements of Physics,' page 224, and in most of the textbooks of physics. Some one of these will doubtless be within your reach. All these agree that the blackened faces absorb heat more than the bright faces of the mica disks, and thus become hotter than the bright faces. In turn they radiate the heat more rapidly, and thus a reaction force of the nature of a pressure is produced, which causes the fly to turn just as a rotary lawn sprinkler is turned by the reaction of the pressure of the water. An iron ball heated below redness will cause the radiometer to rotate in the dark, showing that light is not necessary to produce the effect, but that heat alone is competent for the explanation of the instrument. It was at first thought that light caused the rotation, but that has been abandoned.

(12222) O. R. says: Relative to Query 12217 in issue of April 2nd, 1910, the distance of the moon—240,000 miles—is only the *radius* of a circle, the circumference or orbit would approximate 1,440,000. T. H.'s calculation would then work out so that the moon would subtend an angle of one-half degree, which practically corresponds with the telescopic measurements. A. In Query 12217 the writer used the radius of the moon's orbit where he should have used the diameter, and so all his calculation was wrong. Otherwise his reasoning was right, and he would have found the moon's apparent diameter to be a half degree had he not made this mistake.

(12223) C. L. W. asks: That introducing resistance into a circuit reduces the number of amperes flowing is, of course, plain, according to Ohm's law; the amperes being equal to the electromotive force divided by the resistance in ohms. I have also always been under the impression that resistance introduced into a [illegible]

voltage of the circuit after the current had passed through the said resistance, and that this voltage would fall according as more or less resistance was introduced. The following experiment is therefore hard to explain, if this is so: We connected two 110 volt lamps in series on a 220-volt circuit, and in the opened point as shown below, after the current had first passed through the lamps, inserted a large standard voltmeter, which read 218 to 220 volts. This was repeated many times, with the greatest precautions as to connections; and also on other sources of supply, and the results were the same, in a general way apparently no drop of any appreciable extent having occurred by the passage of the current through the lamps, although of course the amperes were cut down What is the explanation of this? Much discussion has arisen over it, and the claim made that the voltage should have been reduced. A. The case of the lamps and the voltmeter as you describe it is no exception to Ohm's law The resistance was not that of two lamps in series, but of two lamps and a voltmeter which had a resistance of many thousand ohms. The current in amperes became inconsiderable because the resistance was so high, and the voltmeter registered only the voltage. The voltage would be the same as if the lamps had not been in series in the line. No amperes were flowing, or at most a very small fraction of one ampere The point is this the voltage at the end of an open circuit is the same as that anywhere along the circuit The drop between any two points of a closed circuit is proportional to the resistance between those two points. If the circuit which you show in your figure had been closed the lamps would have been lighted, showing that current was flowing, and the voltmeter would then have shown 110 volts drop between the two terminals of each lamp This is in strict accordance with Ohm's law

(12224) C A. Y says Why do not seven new gravity cells connected in series give about 7 volts after being set up and short circuited for 24 hours? I bought seven gravity cells for use in charging a 6-volt-60 A. M. P hour storage battery, but I cannot make them give more than about 2¾ to 3 volts, although each one gives a particle over one volt, and two in series show about 1½ volts, and three in series about 1¾ volts, etc A We are not prepared to say positively why you have so low a voltage for your battery in series. If we saw the battery, we might be able to tell what is required. We suspect that you kept it on short circuit too long and that the zinc sulphate solution is saturated If the colorless liquid reached down nearly or quite to the coppers, this is the case You should take out some of the zinc sulphate from the top and fill in with water again.

(12225) J B says: I have a magnet needle belonging to an old surveyor's compass which has lost its magnetism. Will you please tell me through Notes and Queries how to renew it? A The best mode of magnetizing a compass needle is to draw it across the pole of an electromagnet. If you use the north pole of the magnet, draw the south end of the needle last from the north pole After drawing the needle from the north pole of the magnet several times reverse the needle and draw it across the south pole of the magnet, drawing its north end last from the south pole of the electromagnet A compass needle may probably be magnetised sufficiently by drawing it in the same way across the poles of a horseshoe magnet If you have not the apparatus for doing this, take the needle to the electric light station and ask the engineer to magnetise it for you.

(12226) B B says 1 What is brake horse-power? A The brake horse-power of a machine is the power it can exert as determined by means of a brake upon the axle or pulley of the machine You will find an article upon this mode of measuring power in our SUPPLEMENT No. 1787, price ten cents. 2. What is meant by ultra violet? A The ultra violet region of the spectrum is the part which the eye cannot perceive because the waves are too short to affect the retina The longest waves below the red do not affect the retina and are also invisible To these the name "infra-red" is given The colors of the rainbow run from the red through yellow, green, and blue to violet. Beyond the violet the eye can see nothing But there is a very large region there which can be explored by other means, such as the photographic plate or the fluorescent substances.

(12227) C. H. W says. I would like to hear through your columns a satisfactory explanation of the following. Take an ordinary flat-iron and a gasoline torch such as is used by plumbers, etc. Lay the flat-iron on its side, and turn the full force of the torch against the face of the iron. Water will now condense and collect in large drops on the face of the iron, and will continue to collect until the iron gets hot enough to evaporate the water A. All natural atmospheric air contains a certain proportion of moisture, i. e., water evaporated and in suspension. Most gasoline also contains a percentage of water Consequently the gasoline vapor in a torch or engine contains moisture, being a mixture of air and gasoline. Upon the hot gas or flame impinging upon a cold iron or other surface, the moisture is condensed just as the moisture in your breath, otherwise invisible, is condensed into little drops of water on a cold window pane when you breathe upon the latter.

NEW BOOKS, ETC.

THEORETICAL PRINCIPLES OF THE METHODS OF ANALYTICAL CHEMISTRY. Based Upon Chemical Reactions. By M G Chesneau. Translated by Azariah Thomas Lincoln, Ph.D., and David Hobart Carnahan, Ph D. New York. The Macmillan Company, 1910 8vo.; 184 pp Price, $1.75.

The book takes up the influence of the physical state of precipitates upon their purification by washing, the theoretical principles involved in methods based upon irreversible reactions, as well as a study of methods based upon reversible actions. In Chapter III we have the study of principles involved, according to the calorimetric theory, in reversible actions, in Chapter IV the presentation of the electrolytic theory of these reactions, and in Chapter V a comparison of these two methods. The next chapter deals with the general processes which produce complete precipitation in double decomposition, and inversely which cause precipitates insoluble in water to become soluble. In the final chapter the principles established in the preceding chapters are applied to some particular methods based upon double decomposition

THE EVOLUTION OF WORLDS. By Percival Lowell. Pp xiii + 262, 12 plates and 56 text cuts. New York. The Macmillan Company, 1909 $2.50 net.

To those who are familiar with Prof Lowell's books on Mars, the cosmogony which he outlines in this latest work of his must come as a surprise. In his earlier works he pinned his faith to the *La Place nebular hypothesis*, now he practically adopts the Moulton Chamberlin "planetesimal" theory, without calling it by that name, which seems like to a reversal of himself. Mr Lowell's proneness to see markings upon other planets than Mars finds expression once more in this volume, for we note that he still insists upon the appearance of dark spots on Venus, spots which he regards as fixed features, and which no other astronomer has ever seen Contrary to the usual supposition that Venus is surrounded by a dense atmosphere, Mr Lowell holds that its atmosphere is of the thinnest, and that the planet's brightness is due to the attenuated atmosphere The sections on Mars reiterate his well known views on the habitability and gradual decay of that planet The book is written in Mr Lowell's usual style, a style which is most attractive to the lay reader but which is characterized by occasional chasing of the odd word, and therefore affected at times. For good, popular scientific reading, even though it presents only the very *personal views of its author, the book is certainly to be commended.*

HANDBUCH FÜR HEER UND *FLOTTE* By George von Alten. Berlin, Leipzig, Stuttgart, Vienna Deutsches Verlagshaus Bong & Co

The two installments of the "Handbuch für Heer und Flotte" which lie before us begin with "Bristol" and end with "Carnotscher Kreisprozess." Among the articles which deserve to be particularly mentioned are those on Bronze, "Brücken" (an excellent exposition of the various types of bridges employed for military purposes) "Brasilien" (a *good geographical and military consideration* of the biggest country in South America), "Burg" (in which various forms of medieval strongholds are considered)

HEALTH PROGRESS IN THE ADMINISTRATION OF THE WEST INDIES. By Sir Rubert W Boyce, M.D, F.R.S New York E. P Dutton & Co, 1910. 8vo, 328 pp Price, $3 50

The *epitomized record of the progress* or sanitation and sanitary administration in the West Indies is the outcome of a visit which the author paid to the West Indies in 1909 in order to investigate an epidemic of yellow fever which was present in the colonies of Barbados at the time. While making the investigations on the subject of yellow fever in Barbados, he was requested by the Governor of the Windward Islands and the Governors of Trinidad and British Guiana to prolong his stay and visit their respective territories and report upon the health conditions obtaining in these colonies. The results of the author's experiments as described in the present volume is of value not only to the medical and business man, but also to the tourist who wishes to reside in or visit these beautiful colonies. The book is beautifully illustrated with interesting half-tones.

THE PLANT CELL By Harold A. Haig, M.B, B. S Lond London: Charles Griffin & Co, Ltd Philadelphia, J B. Lippincott Company, 1910 12mo, 207 pp.

The author's aim has been to deal with the study of structural and physiological botany from a biological standpoint, in which the working substance of a cell, namely, the protoplasm, is given the first place in importance, the subsequent changes which are produced in form, function, etc., being looked upon as being due to the sole agency of the protoplasm, influenced by the various physical and chemical stimuli which may be brought to bear upon it. This method of dealing with the cell, whether animal or vegetable, has been found, in the writer's experience, to be a rational and useful one when such a wide subject as biology is first approached by the student. The section on cell division has been presented in rather full detail, on account of the great importance attached nowadays to cytological phenomena in which the nucleus is involved. With regard to the illustrations, a *few photomicrographs* have been inserted, and these give a rather more realistic aspect to one or two of the more difficult sections, such as those on embryology and nuclear division

THE UTILITY OF ALL KINDS OF HIGHER SCHOOLING An Investigation By R. T Crane. Chicago, 1909 8vo., 331 pp Price, $1 00 net.

This edition gives further results of the author's investigation of the utility of academic or classical education for young men who expect to pursue a commercial or industrial career The following subjects have been investigated and studied Technical Education in Manufacturing, Technical Education in Civil Engineering, Technical Education in Electrical Engineering, Agricultural Colleges Manual Training in the High Schools, Business Education Medical Education, Scientific Education; Rural Schools.

ON THE TRAIL OF WASHINGTON By Frederick Trevor Hill. Illustrations in color by Arthur E. Becher New York and London D Appleton & Co, 1910 276 pp, 8vo Price, $1.50 net.

For more than a century Washington was exalted as a model of manners and morals—and portrayed as a prig, he was idealised as a hero—and rendered unreal, he was glorified as the father of his country—and denied all human fellowship with his kin, he was invested with every virtue, and divested of all virile character That he survived in the affections of his people is the best demonstration of his true greatness Of recent years, however, there has been a notable effort to depict the man as he really was, a man with good red blood in his veins, good common sense in his head, good kindly feeling in his heart, and a good honest laugh This humanising of Washington has been the work of eminent editors, historians, and collectors, and their investigations during the past twenty years have virtually revealed Washington to Americans for the first time. It is to place before readers, young and old, the results of this modern research that the writer retells the story of Washington in these pages

THE DESIGN OF CONDENSING PLANTS. By F W Wright. London The Technical Publishing Co, Ltd., 1909 203 pp, 12mo, illustrated Price, $1 50

Considerable attention has been devoted during the past few years to the subject of *condensing equipment for steam plants*, and scattered throughout the technical press and in the published transactions of engineering societies, are to be found a number of valuable papers embodying the results of careful and extended observations and experiments by able investigators So far, however as the author knows, there was no book devoted exclusively to a consideration of the various problems involved, and in many of the standard text books on the steam engine, the references to the question of condensing are very brief The pages are a modest attempt to supply the lack in a volume of such dimensions and price that it should be within the reach of all who are interested in the subject.

SCIENTIFIC LIVING FOR PROLONGING THE TERM OF HUMAN LIFE. The New Domestic Science, Cooking to Simplify Living and Retain the Life Elements in Food By Laura Nettleton Brown New York The Health-Culture Company, 1910 284 pp, 12mo. Price, $1 00

A great truth is emphasised in this book, namely, that in the ordinary processes of cooking the organic elements become inorganic and food values are destroyed. This dietetic idea is most important, and it is claimed by the author that when generally known and made practical it will restore the racial vigor as nothing else can, free woman from the slavery of the cook stove and become a large factor *in the solution of the servant problem.* The volume is thoroughly sensible and enlightening, original without being cranky radical without being faddish withal, practical plain and entirely helpful

HOVEY'S HAND BOOK OF THE MAMMOTH CAVE OF KENTUCKY A Practical Guide to the Regulation Routes, With Maps and Illustrations By Horace Carter Hovey, D D, F G S A Louisville John P Morton & Co, Inc, 1909 64 pp., 16mo. Price, 25 cents.

The writer is well known to the readers of the SCIENTIFIC AMERICAN, having written many articles on the subject of caves and caverns for its columns. The present book may be regarded as an excellent guide to the Mammoth Cave and should be in the hands of all those who may think of visiting this unique wonder

ENGINEERING THERMODYNAMICS By C F Hirshfeld, Professor of Power Engineering, Cornell University New York: D Van Nostrand Company, 1910. 16mo boards, 78 pp Price, 50 cents.

The following pages represent an attempt to develop the principal thermodynamic properties of gases and of vapors in such a manner that the underlying principles may be clearly recognized. It is thought that a thorough understanding of the laws developed in the text will, on the one hand give a working knowledge sufficiently extensive for most engineering purposes, or on the other will enable the student to more easily follow the generalized and complicated cases considered in the large standard works on the subject

SHELL-FISH INDUSTRIES By James L. Kellogg, Professor of Biology in Williams College New York Henry Holt & Co 1910 Illustrated by half tones and original drawings. 8vo, 361 pp Price, $1 75 net

This fills a much needed gap in the literature of natural history, or what may be called applied natural history It covers the classi*fication propagation, and distribution of shell* fish For the person who eats oysters, clams or scallops, there is information on their structure life histories and habits. A chapter is devoted to shell fish as collectors and carriers of disease organisms. The oyster culturist will find the life history of bivalves from the egg period to the time when they reach the market, a comparison of various culture methods, and a description of oyster fields in various parts of the world

HALLEY'S COMET By David Todd, M A, Ph D, Professor of Astronomy and Navigation and Director of the Observatory, Amherst College New York The American Book Company, 1910 8vo, paper Price, 50 cents.

The major portion of this pamphlet on comets is a reprint of the comet chapters of Prof Todd's "New Astronomy" The reprint is preceded by an introduction in which the usual information on Edmund Halley and the manner in which he applied Newton's law of gravitation to the comet of 1682 is described as well as the circumstances of the comet's present return On the whole it must be stated that of all the cheaper works which have been published to meet the popular demand for a simple account of Halley's comet Prof Todd's is the most accurate and the most informing

THE PASSION PLAY OF OBERAMMERGAU Translated from the German text, with a Historical Introduction By Montrose J Moses New York Duffield & Co 1910 12mo, 118 pp Price, $1 50 net.

The volume before us is printed on delightful light weight paper so that we have no hesitancy in recommending it as an ideal text for visitors who are going to have the supreme *pleasure of witnessing the Passion Play* The text which is sold in Oberammergau and Munich is apt to be bad and very dear and it is really good economy to take along a book like the present volume with its black faced readable type The writer of this book review had the pleasure of seeing the Passion Play in 1890 he therefore thinks that possibly he is competent to review a book on this subject There are a number of important features. The list of *dramatis personae* are contrasted with various years such as 1890 and 1900 The history of the Passion Play is given with valuable notes referring thereto The four ancient texts of the Oberammergau Passion Play are then examined The description of the play house etc, follows together with the statement issued by the Burgomaster showing the ratio of expense to receipts. This shows that in 1890 the salaries of the 747 players were only $48,000 or an average of $64 each which is not very large pay for an all summer's work which interferes very materially with their regular pursuits This shows that the *Passion Play as regards the members* is not very much of a money making scheme There is however a considerable amount made each year the Passion play is produced by those who have concessions of various kinds, such as the photograph concession The text itself of the play is admirable and is followed by the best bibliography of the subject which we have ever seen

THE ROMANCE OF MODERN CHEMISTRY A Description in Non Technical Language of the Diverse and Wonderful Ways in Which Chemical Forces Are at Work and of Their Manifold Application in Modern Life By James C Philip, D Sc Ph D Philadelphia J B Lippincott Company, 1910

For a book frankly intended for popular reading, it must be confessed that the author has succeeded in producing a most readable account which ought not to exact too much intellectual effort on the part of the reader in endeavoring to follow the development of chemistry and to discover some of its modern achievements. The subjects discussed are the following Dawn of Chemistry Alchemy and the Philosopher's Stone Nature's Building Material Invisible Substances and How We Know of Their Existence Elements with a Double Identity, Metals, Common and Uncommon Where Two Metals are Better than One, Acids and Alkalis Natural Waters and What They May Contain Chemical Changes which Produce Light and Heat How Fire Is Made Nature's Stores of Fuel More About Fuel Flame, What Is It? Explosions and Explosives Below Zero Chemistry at High Temperatures Chemistry of the Stars, Chemistry and Agriculture, Sugar and Starch, Fats and Oils, How Man Competes with Nature; The Adul

toration of Food The Value of the By Product, Valuable Substances from Unlikely Sources, Chemistry and Electricity, Some Interesting Facts About Solutions, From Solutions to Crystals, Great Effects from Small Causes How Trifling Observations Lead to Great Discoveries

COMETS Their Origin, Nature, and History By Henry W Elson New York Sturgis & Walton Company, 1910 Illustrated, 54 pp Price, 50 cents

In this little book Mr Elson has presented in readable and simple form the more elementary facts relating to comets. In an introductory chapter on the solar system and stars he traces the relation between Newton's discovery of the law of gravitation and the Copernican theory of a heliocentric planetary system. With some regret we notice that he illustrates his explanation of gravitation with the old fable of Newton's apple for which Voltaire is responsible and which has long been discredited No attempt whatever is made to explain the physical constitution of comets or to give any explanation of tail formation or a summary of recent spectroscopic study, omissions which may have been intentional because of the difficulty in setting forth the more difficult aspects of cometary phenomena in a short, popular essay

THE INTERPRETATION OF RADIUM Being the Substance of Six Free Popular Experimental Lectures Delivered at the University of Glasgow, 1908, by Frederick Soddy, M A New York G P Putnam's Sons, 1909 8vo, 256 pp, 31 illustrations Price, $1 75 net.

The substance of half a dozen popular lectures given at the University of Glasgow are here presented in book form The matter has been rewritten so as to secure continuity of treatment The subject is presented in non technical language and is intended to be of service to workers in other fields of investigation as well as to the general public The recent important discoveries of Prof Rutherford and his experiments with Dr Geiger in counting the number of alpha particles expelled by radium have been added to the book. Altogether the work will be found most interesting to the general reader

NAUTICAL SCIENCE In Its Relation to Practical Navigation. Together with a Study of the Tides and Tidal Currents By Charles Lane Poor, Professor of Astronomy in Columbia University New York and London G P Putnam's Sons, 1910 8vo, 31 illustrations, 11 plates, 320 pp Price, $2

Astronomy finds its most practical application in navigation However, many a navigator knows very little astronomy as most of the astronomical matter which is necessary for the guiding of his vessel is presented to him in the form of tables and formulæ which he accepts without inquiring into their mathematical significance The present work attempts to explain in non technical language and without the use of complicated mathematical formulæ the fundamental facts and principles that form the basis of all navigational methods. A large part of the book is devoted to an explanation of tides and tidal currents, and their causes, giving the recent researches of Dr Harris which show that the tides of each ocean basin are practically independent of those of the rest of the world.

LUDWIG DARMSTAEDTERS HANDBUCH ZUR GESCHICHTE DER NATURWISSENSCHAFTEN UND DER TECHNIK Von Professor Dr L. Darmstaedter Berlin Verlag von Julius Springer, 1908. 1262 pp Price, $4

It would be difficult indeed to exaggerate the importance of this chronology of inventions and scientific discoveries The names of the distinguished editor and his collaborators are in themselves sufficient guarantee of the accuracy of the work and the painstaking labor which its compilation involved For all that no one can possibly realize how arduous must have been the task of preparing this work without having actually handled the book itself Its 1200 odd pages are packed with concise and yet lucid statements of the principal scientific and mechanical discoveries year by year beginning with 7500 B C and ending with 1908 An admirable index facilitates reference

PHYSICAL AND COMMERCIAL GEOGRAPHY A Study of Certain Controlling Conditions, of Commerce by Herbert Ernest Gregory Albert Galloway Keller and Avard Longley Bishop Boston and New York Ginn & Company, 1910 8vo. 269 pp Price, $3 00

From the time when they are first offered to the child for study the facts of production and trade have been listed rather than interpreted The books which have dealt with these matters have been prevailingly of a statistical nature and the study of what they have had to give has too often reduced itself to a mere mnemonic exercise And yet there are behind the facts of trade as behind all facts certain principles about which they can be grouped and which serve to lend them life and meaning, and it is interpretation rather than arbitrary memorizing which is of educational importance The present work which is intended to be used as a text book, is based on a consideration of this idea. It is seldom that we see the authorship of a book split up into three parts, the result, however, in this case appears to have been beneficial, and it has undoubtedly added much to the value of the book that three professors of science have co-operated in its production It is a most excellent book which can also be added with advantage to the library

SCHOOL ARCHITECTURE. A Handy Manual for the Use of Architects and School Authorities. Compiled by William George Bruce Milwaukee Johnson Service Company, 1910 18mo., 385 pp Price, 50 cents.

The present edition embodies a decided advance over the former efforts and a practical departure in plan of presentation. In scope it is extended so as to include every phase of scientific school-house planning and to embody the latest and best thought and experiment on the subject. In presentation an entirely new plan has been adopted Instead of presenting all subjects in topical form, arranged in alphabetical order, it has been planned to arrange the subjects with a view of giving them logical sequence and continuity The ready reference feature which was emphasized in the former editions is preserved in an ample index and table of contents.

INTERNAL LUBRICATION OF STEAM ENGINES By T C. Thomsen, M Soc D.C.E. London. The Technical Publishing Co, Ltd., 1910 12mo 97 pp. Illustrated Price, $1 00

This book has been written in the hope of it proving to be of some assistance to mechanical engineers directly interested in the satisfactory running of steam plants, to improve the internal lubrication of their engines, and if they have troubles, to give such information as will be useful in determining the nature of the trouble and the probable cure Designers of steam plants may also find points of interest and value in scheming means for applying cylinder lubricants, and the best way of distributing them to the internal surfaces needing lubrication Very little is said about the chemical and physical properties of cylinder lubricants, or about the various methods employed in distilling and refining, the main points under consideration being the mechanical side of the question

TAVERNS AND TURNPIKES OF BLANDFORD, 1733-1833 By Sumner Gilbert Wood. Blandford, Mass. Published by the author, 1908 $2 00

In no small degree the tavern and turnpike story shapes and describes the social development of a town like Blandford, so rich in fact and incident, so the author concluded to publish this monograph before running the larger risk always attaching to the publication of the conventional local history, the circulation of which is necessarily narrow Should this little volume meet with such response as to warrant the venture, it is the author's intention to follow it with another on the "Homes and Habits of Ancient Blandford." The book is a monument of industry and many of the illustrations which are given show bits of old New England

FREIGHT TRANSPORTATION ON TROLLEY LINES By Charles S Pease. New York McGraw Hill Book Company, 1909 16mo 62 pp. Price, $1 00

Generally speaking the freight business of a traction road is more profitable than its passenger service, while with electric traction lines this relation will not obtain, therefore, the subject of goods transportation is worthy of the close study of the company intending to follow as far as may be expedient the practice of the great trunk lines. A monograph on the subject is therefore far from being out of place The whole subject seems to have been treated in an admirable manner Special attention is given to stationery

CEMENT AND HOW TO USE IT Edited under the supervision of William A. Radford Chicago The Radford Architectural Company, 1910 8vo 369 pp Price, $1 00

The present volume has been prepared in response to numerous requests for a treatise written in simple non technical English which will serve the purpose of a plain working guide to the seclusion of cements and aggregates, the purpose of proportioning and mixing concretes, and the rules obtaining in the many forms of construction to which it has shown itself so well adapted Throughout the volume constant emphasis is laid on the product as distinguished from the theoretical mode of treatment. On account of the intimate relation which cement and concrete now bear to every branch of construction, the present volume will be of great practical value not only to concrete workers but to all other craftsmen engaged in the various trades of the building industry, such as carpenters, steel workers, plumbers, engineers, and others.

THE DESIGN AND CONSTRUCTION OF OIL ENGINES. By A. H Goldingham. New York Spon & Chamberlain, 1910 16mo. 260 pp Price, $2.50

This work has been written with the intention of supplying practical information regarding the kerosene or oil engine, and in response to frequent requests received by the writer to recommend such a book. Whilst many works have been published on the subject of gas engines, some of which refer to or describe the working of the oil engine, no other book, it is believed, is devoted entirely to the oil engine in detail. The work, it is hoped, will be found useful to the draftsman, the engine attendant, as well as to those who own or are about to instal oil engines. The classification of vaporizers has been adhered to as made some few years ago, and a representative engine with each type is described.

FOOLISH QUESTIONS. By R. Goldberg. Boston Small, Maynard & Co., 1909. 18mo, ill. Price, 50 cents.

The present volume is a reproduction of cartoons which were originally published in the New York Evening Mail

AUF VORPOSTEN IM LEBENSKAMPF Biologie der Sinnesorgane, I-Fühlen U-Hören. Von Dr H. Dekker Stuttgart Kosmos Gesellschaft der Naturfreunde. 92 pp.; 33 illustrations.

This is a popularly worded treatise on the biology of the sense organs, devoted chiefly to tactile sensations or peripheral sense organs.

MATTER AND SOME OF ITS DIMENSIONS. Washington, D C. Woodward & Lothrop. 99 pp

SELECTED SHOP PROBLEMS. By George O Seaton Peoria, Ill. The Manual Arts Press. 12mo; 16 plate and 15 pages of text.

GILLETTE'S INDUSTRIAL SOLUTION WORLD CORPORATION By Melvin L Severy Boston The Ball Publishing Company, 1908. 8vo. 594 pp Price, $1.50.

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending May 3, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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TWO NOVEL MOTOR SLEDS.

(Concluded from page 396.)

touches the ground, appears to stand still, while the sleigh slides over it. This is the motion that actually takes place, for the top of the chain travels forward at twice the speed of the sleigh. It will thus be seen that in reality the lower part of the chain in contact with the ground constitutes a surface over which the vehicle itself can move.

The driver has his position on a box behind the engine, which seat forms a receptacle for tools, spare parts and other accessories. That the vehicle has great climbing power has been conclusively proved, for it will ascend steep banks of earth and ride over serious obstacles easily and without any appreciable diminution in speed.

Although this sleigh can carry a party and full equipment, its actual function is to act as a tractor for the haulage of ordinary sledges, the trailing vehicles carrying the loads. Upon completion by the builders, the tractor was taken to Norway by Capt. Scott, and submitted to some exacting trials on snow covered Lake Fefor and the tumbled country in its vicinity, where the conditions were somewhat analogous to those prevailing around the south pole. Heavily laden trailing sledges were hitched on to the tractor and numerous journeys were made among the Norwegian ice fields. The vehicle proved itself fully capable of withstanding rough usage, and Capt. Scott expressed his complete satisfaction with the results achieved.

Very different from this sled in design is one which has lately been put to a series of severe running tests over all kinds of ice and snow in the district of the Silian Lake, Sweden. The accompanying photograph of the motor sleigh was taken in the Easter days of this year, after the above-mentioned tests had been carried out.

The design differs from that of other automobile sleighs in the driving mechanism. The sleigh is propelled by two driving wheels, each fitted with a number of steel paddles between which an elastic frame is fixed. This simple construction thus combines the advantages of a paddle wheel and the Canadian snow shoe, having the propelling capacity of the former on fixed ice and snow surfaces, and the supporting and friction capacities of the latter on loose snow. The flexibility of the frame tends further to prevent the snow from clogging by expelling it from the paddles. The driving wheels run in the tracks made by the sleigh runners, and thus tend to make a good contact surface for the paddle wheels. In case the snow is not compressed enough by the runners, the paddle wheels sink by their own weight into the snow, and compress it sufficiently by means of the frame. The paddles engage with the compact snow by cutting through the crust as knives, and work on account of their breadth, against such a large wedge of the frozen snow surface, that an effective counter pressure is obtained which would otherwise be impossible if the driving wheels were, for instance, provided with spikes instead of paddles. The sleigh is in this instance driven by a 6-horse-power double-cylinder air-cooled gasoline motor. The motor sleigh illustrated is designed to serve only as a traction engine, to which any kind of sleigh can easily be attached or detached within a few minutes.

It is of course easy to make the motor sleigh as self-contained as an ordinary automobile, and the electrically-driven forerunners of this sleigh were successfully built in this way.

The motor sleigh is governed by means of a very ingenious and reliable steering device for remote hand operation. The power required for steering is transmitted from the operating hand-wheel through flexible steel tubes to the motor.

In the tests a speed of 24 miles an hour over a smooth ice surface was attained. When traveling over the snow and ice-covered roads, which were in a very bad condition on account of the prevailing thaw, a speed of 10 miles an hour was attained, the total weight drawn being over one ton. During a running test of several consecutive hours, the average speed was 19 miles an hour.

The inventor is a Swedish engineer, Mr. H. Hakanson.

An Industrial Laboratory for the Improvement of the Incandescent Lamp.

Although the establishment of a research laboratory by a large manufacturing organization is not a novelty, the inception by such an organization of a laboratory which has for its object the development of science rather than the improvement of some industrial commodity is probably without precedent. For that reason, Mr. E. P. Hyde calls attention in a recent number of Science to the new physical laboratory of the National Electric Lamp Association, even though it is still only in a formative state. The object of this laboratory is scientific, the specific purpose being the development of those branches of science with which the art of lighting is closely associated. The fundamental idea which has prevailed in the organization of the work is the proper co-ordination of physics and physiology, the proper co-operation of the physicist, the physiologist and perhaps the psychologist.

The organization of the laboratory is proceeding with this idea as the foundation. The development contemplates no sharp distinctions among the different divisions of the work. The problems to be investigated, however, group themselves roughly into three classes, and therefore require, in order to insure the proper attention to each, a threefold division in the organization. The three groups of problems to be investigated may be classified as (1) those that have to do with the production of luminous energy, (2) those that have to do with the utilization of luminous energy, and (3) those that have to do with the effects of luminous and attendant radiation.

Under the first class will come the investigation of the laws of radiation, and of the radiating properties of matter. The problems in this class are purely physical and the corresponding division will be intrusted to a competent physicist.

Under the third class will come the investigation of the effects of light and the attendant radiations on the eye, on the skin and on microscopic organisms. The problems in this class are physiological, and the corresponding division is under the charge of a trained experimental physiologist.

Intermediate between these two classes of problems (the first and the third) which are distinctly different, there is another (the second) which forms the connecting link. Touching on one side the physical production of light, and on the other the physiological effects of light, this intermediate division of the work will embrace most of the scientific problems peculiar to illuminating engineering. Investigations of the absorbing, reflecting and diffusing properties of matter, the measurement of light, i. e., photometry, and the study of the complex phenomena of color and color sensation, properly come within the scope of this department of the work.

Scientific Cider Making.

Messrs. Alliot and Gimel recently presented a paper to the Académie des Sciences concerning the good results obtained in the production of cider by washing the apples with an oxidizing solution. Inasmuch as cider is the usual beverage of the populations of the north and west of France, its manufacture should concern hygienists as well as technicians. In many cases the quality of the product is much inferior to what it should be were the process well carried out. The washing of the apples is indispensable to free them from the impurities which they carry, but we must also take account of the defective quality of the water which is available in many cases. The authors' previous re-

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searches showed them that oxidizing agents could be used to advantage, and they experimented with hydroxyl, ozonized water, and hypochlorites of soda and of lime in solution in the water which is used for the washing. Used in the proportion of 40 to 60 centigrammes per liter of water (0.4 to 0.6 per 1,000), which is more than enough to destroy pathogenic germs of the human species, they find that hypochlorite of lime has a good influence on the activity of the pectase, which is the coagulating diastase of the pectic matters of the juice of apples. Where the fruits carry much impurity they should first be washed in ordinary water before immersing them in the oxidizing solution. The tests carried out first in the laboratory in 1905 were pursued in the cider-making districts during the seasons of 1907-8 and 1908-9, and they led to the following conclusions. First, the addition of hypochlorite of lime in the above proportions according to the state of purity of the fruit, assure the purifying of the doubtful waters as to bacteria for the present purpose. The juice of the fruit thus treated is found to clarify rapidly. The coagulation of the pectic matter is always well carried out and we have formed an abundant brown surface layer. This assures the stability of the cider with time in this respect. The diastases, especially the maloxydase, are eliminated by precipitation, so that we avoid the principal cause of darkening of the cider. It is also found that the hypochlorite has a favorable selective action on the *Saccharomyces mali* and a destructive action on the anaerobic germs, and it thus solves practically and simply the problem of a pure fermentation. By adding to this treatment the method of repeated under-drawings, we can obtain cider which will keep much longer, and this is of interest for producing bottled cider. There is no harmful matter introduced by the present process. Comparative analysis of cider made from treated and from untreated apples shows a marked advantage in favor of the former.

Military Kites.

Kites, as well as dirigibles, captive balloons, and aeroplanes, may be made serviceable in military scouting, and their simplicity makes them especially valuable. Furthermore, they can be employed with any velocity of wind between 16 and 66 feet per second, whereas the use of a captive balloon becomes difficult if the velocity of the wind exceeds 26 feet per second. Experiments recently made at Boulogne by Capt. Saconney show that it is quite practicable to carry two persons by means of a large kite. The kites used in his experiments were of the Cody type with four sustaining planes and with triangular stabilizing wings. In this method of construction each rectangular cell is strengthened by diagonal rods of bamboo to which the stabilizing wings are attached. The apparatus consisted of a series of kites connected together, for the purpose of supporting the cable, and of a second series of kites attached to a very light carriage, which moved along the cable, and from which the car or basket was suspended. Kites can nearly always be used at sea and on the coast. They are simpler and less expensive in every way than balloons and they are also strong and easily repaired. These qualities should make them valuable for many purposes in military and especially in naval operations.

A wireless telegraphy station near Berlin claims to have established a record in combined overland and sea transmission of wireless messages. The station recently succeeded in maintaining wireless communication with a Woermann liner during the entire voyage from Hamburg to the Cameroon. The greatest distance signaled was 6,600 kilometers (over 4,000 miles). Although messages had to pass over the Alps, the Algerian tableland, and the Adamana Range, communication was, it is stated, effected with astonishing ease.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. In every case it is necessary to give the number of the inquiry. Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

BUSINESS OPPORTUNITIES

WANTED by a firm of Sheffield, England, Steel manufacturers, a firm to sell First Class Quality High Speed Steel and Superior Quality Files. Only applications from those who can command business will be considered. For further particulars apply Box 2110, F. E. Browne's Advertising Offices, 163 Queen Victoria Street, London, England.

Inquiry No. 8918.—For manufacturers of "Wydt's Electro-Catalytic Sparking Plug."

PATENTS FOR SALE.

FOR SALE.—Collapsible step ladder, patented Feb. 4, 1908, and Feb. 16, 1909. Patent numbers 878,850 and 912,944. Address P. O. Box 88, Brooklyn, N. Y.

Inquiry No. 8987.—Wanted, the manufacturers of the Van Winkle Woods & Sons, and the Weber power motors.

FOR SALE.

FOR SALE.—A number of Corundum, Alundum and Craigleith Stones, sizes ranging from 20" to 27" dia., 1¼" to 3" face. Some of the wheels are straight face others beveled. These are offered at very attractive prices and those interested may secure prices and inventory by communicating with the Bausch & Lomb Optical Co. Rochester N. Y.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

TYPEWRITERS.

REAL REMINGTON $12.75.—One machine only in new localities to secure desirable agent. Special agents prices supplied on all makes of typewriters. 6 ribbons $1.50. Standard Typewriter Exchange, 23 Park Row, New York.

Inquiry No. 9016. Wanted machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

LISTS OF MANUFACTURERS.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9023.—Wanted to buy silk machines from re-reeling twisting, doubling, to the final process of making it into clothes.

MISCELLANEOUS.

CHEMICAL analysis, investigation and research work. Processes devised. Correspondence invited. J. F. Dunnigan, Chemist, Milburn, N. J.

Inquiry No. 9029.—Wanted catalogues and all information on machinery for braiding straw in manufacturing straw hats.

SITUATIONS WANTED

PRACTICAL mechanic is open for position of responsibility either to assist manager, superintendent or inventor. 20 years experience. A. X., Box 773, N. Y.

Inquiry No. 9034.—Wanted, the address of the Chipman Electric Purifying Co.

SALE AND EXCHANGE.

FOR SALE.—Engine lathe. Our regular $75.00 lathe complete, with a face plate, two centers, wrenches and a full set of change gears to cut all size threads. Price only $48.50. L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9043.—Wanted the address of Farney Safety Razor Co.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9066.—Wanted to buy machinery to manufacture seed corn racks.

Inquiry No. 9075.—Wanted to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

Inquiry No. 9076.—Wanted, the address of parties in Canada who could make a safety razor.

Inquiry No. 9077.—Wanted, the address of manufacturers that make small articles of wood, such as checker boards, etc.

Inquiry No. 9078.—Wanted, the address of manufacturers of sewer pipe, made of fiber and asphaltum, suitable for laboratory use.

Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

Inquiry No. 9083.—Wanted, the address of firms manufacturing small beer brewing plants, from 50 to 100 gallons a day.

Inquiry No. 9090.—Wanted manufacturers of suspender and supporters supplies, also patent adjustable bachelor buttons.

Inquiry No. 9092.—Wanted, the address of some firm who manufacture permanent lamp wicks.

Inquiry No. 9094.—Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9096.—Wanted, the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted, address of makers of impulse water wheels.

Inquiry No. 9098.—Wanted, name and address of the manufacturers of the cooniser.

Inquiry No. 9099.—Wanted, address of manufacturers of machinery for making wire cables.

Inquiry No. 9101.—Wanted, addresses of manufacturers of a dip or magnetic needle, for exploring for iron ore.

Inquiry No. 9104.—Wanted, addresses of manufacturers under the name of A. D. Co. Standard.

Inquiry No. 9107.—Wanted, addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dual Desk Clock.

Inquiry No. 9112.—Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114.—Wanted name and address of manufacturer of the Amo Lantern Globe. Fits all lanterns.

Inquiry No. 9116.—Wanted a machine for making tin tubs, similar to Wm. Mitchell's G. & J. tubs and Waverly tubs.

Inquiry No. 9117.—Wanted names and addresses of the manufacturers of pedometers.

Inquiry No. 9118.—Wanted, a treatise for a machine engine, built upon the principle of the Maxim silencer, recently brought out for use on rifles.

Inquiry No. 9119.—Wanted, name and address of the manufacturer of Reglin bullet-proof cloth.

Inquiry No. 9120.—Wanted, the address of the Ideal Fuel Feeder Co.

Inquiry No. 9121.—Wanted, manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9124.—Wanted, name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9127.—Wanted, address of L. Derbigny, manufacturer of a family ice machine for $15.00.

Inquiry No. 9132.—Wanted, manufacturers of a gasoline traction engine with a hoisting attachment; in other words, the machine will be used as a portable stump puller to pull sassafras roots, used in making oil of sassafras.

Inquiry No. 9134.—Wanted, a small hydraulic motor, capable of giving about one horse power with a water power of 65 lbs. per square inch.

Inquiry No. 9135.—Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted, the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted, the address of manufacturers of machines capable of forming a number (12 or more) of pieces of paste about 35 mm. x 40 mm. x 6 mm., made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 4 mm. The process could be somewhat similar to biscuit making.

Inquiry No. 9139.—Wanted, the name and address of some manufacturer of a coffee mill run by water motor.

Inquiry No. 9140.—Wanted, manufacturers of disc records for gramaphones that use a sapphire point instead of a steel needle.

Inquiry No. 9142.—Wanted, name and address of the manufacturers of an air mattress.

Inquiry No. 9144.—Wanted, manufacturers of machinery for making soda water tubes, commonly known as straws.

Inquiry No. 9145.—Wanted, to buy machinery to load blasting caps or detonators.

Inquiry No. 9146. Wanted address of firms engaged in die cast work.

Inquiry No. 9147.—Wanted manufacturers of machinery for making manilla rope and all kinds of ropes from fibre of century plants, such as maguey agave, henequen mauvlera or any such fibres.

Inquiry No. 9148.—Wanted manufacturers of machinery for weaving bags of fibre also manufacturers of machinery for separating fibres as above mentioned from their respective plants.

Inquiry No. 9149.—Wanted, manufacturers of machinery for roasting coffee for small and large industries.

Inquiry No. 9150.—Wanted, manufacturers of machinery for the manufacture of French heels for ladies' shoes.

Inquiry No. 9151.—Wanted, manufacturers of cocoanut oil machinery.

Inquiry No. 9152. Wanted, the address of the Graham Safety Lamp Filler and Ventilator.

Inquiry No. 9153.—Wanted, name and address of manufacturers of a knotless clothes line.

Inquiry No. 9154. Wanted name and manufacturers of a newspaper vending machine.

Inquiry No. 9155. Wanted, the address of manufacturers of an electric milking machine.

Inquiry No. 9156.—Wanted the name and address of manufacturers of a rust proof oil, known as Caochouc Oil.

Lewis L. Ciardelli	956,938
Lifting jack, A. Halvorson	956,877
Light fixture, extension, C. M. Littel	956,823
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Linen smoother, C. Ellis	956,993
Linotype machine, J. H. Allen	956,790
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Liquid separators, liner for centrifugal, O. A. F. Ramstrom	957,002
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Loader, portable, Mogg & Gardner	956,816
Lock, J. H. Wilkins	956,561
Lock alarm, J. F. Howard	956,580
Locking device for rotative parts, F. A. Schluns	956,605
Locomotive ash pan, A. J. Brodhead	957,144
Locomotive blower and air pump exhaust pipe, F. L. Holcomb	956,706
Locomotive rack rail, C. A. Pratt	956,782
Loom filling replenishing, J. Northrop	956,726
Loom, picker stick check, S. D. Eubanks	957,047
Loom shedding mechanism, P. Laboato	956,980
Loom temple, J. Northrop	956,720
Looms, lay for narrow ware, N. H. Holmes	956,854
Looms, thin place detecting mechanism for, S. D. Eubanks	956,574
Mail bag catcher and delivery apparatus, C. B. Huss	956,985
Mail collecting apparatus, J. A. Steinmets	956,748
Mailing tube, H. L. Gray	956,686
Main and pipe cleaner, Greenan & Radford	957,051
Manure loader, J. Nold	957,085
Mash and the like from noxious odors and flavors, freeing fermented, A. P. Stitzel	956,650
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Metal scraping machine, P. B. Bissell	957,031
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Metallic tie, R. Cronin	956,628
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Milling machine, Le Blond & Gruene	956,643
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Miter block, R. C. Kellogg	956,711
Mixing machinery, G. H. Petri	957,068
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Mold sander, D. P. Sanders	956,820
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Molding machine, W. O'Connor	956,506
Mop head, W. H. Sachry	957,025
Motor fluid, apparatus for producing a, H. Maxim	956,813
Mower, lawn, W. M. Potter	956,601
Mower, lawn, J. H. Smith	957,009
Mower, lawn, G. A. Culver	957,145
Muffler, W. O. Thomas	956,785
Muffler, E. D. Siser	956,906
Net, fish and fruit, J. F. Fromm	956,802
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Oil burner, H. M. Daggett	956,629
Oil burner, crude, L. Petty	956,895
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HALLEY AND HIS COMET

The year 1910 is destined to be one of the most famous in astronomical history, simply because Halley's comet has returned after a lapse of seventy-five years. Why not learn all about this wonderful comet and about comets in general by reading the following articles?

Scientific American No 19, Vol XCVIII **Gas Phosphorescence and Meteor Trains.** An article in which the investigations of C C Trowbridge of Columbia University are described, showing that the after-glow produced from a vacuum tube resembles closely the effect produced in the sky by the passage of meteors.

Scientific American No 6, Vol XCIX **The Mystery of Comets.** An article in which the famous comets of the last century are enumerated and described and modern cometary theories discussed

Scientific American Supplement No 1728. **Ancient and Popular Ideas About Comets.** Queer superstitions about the strangest of heavenly bodies.

Scientific American No 7, Vol CI **Halley's Comet.** An interesting article by Dr Alexander W Roberts, in which the general history of Halley's famous comet is sketched with comments on its past appearances

Scientific American Supplement No. 1705 **The Next Apparition (1910) of Halley's Comet.** An important article by H C Wilson, with a map giving the position of the comet relatively to the orbits of the planets from September 15, 1908, to July 11, 1910.

Scientific American Supplement No 1632 **Halley's Comet.** An article by F W Henkel, F R A S, which tells how Halley came to discover the comet which bears his name, and how mathematicians have plotted its orbit

Scientific American Supplement No 1770. **Edmund Halley.** A biography by J E Gore, M R I A, of the man who dispelled cometary superstitions and popularized the law of gravitation

Scientific American Supplement No 1773. **Light Pressure and Comets' Tails** An explanation of the vagaries of a comet's tail, by Arthur Stanley Eddington, F.R.A.S.

Scientific American Supplement Nos. 1788 and 1789. **Halley's Comet.** By George F Chambers, F R A S. The most thorough article which has thus far appeared on Halley and Halley's comet

Scientific American No. 13, Volume CII **Condensed Facts About Halley's Comet.** By H W. Griggs. A few facts presented in condensed form for those who wish to follow the course of Halley's comet in the heavens. Maps showing the apparent path of Halley's comet through the heavens and the relation of the orbits of Halley's comet and the planets.

Scientific American No. 16, Volume CII **Halley's Comet at its Brightest.** By Professor Henry Norris Russell A simply worded astronomical article telling how Halley's comet was discovered on its present return, when it will appear at its brightest, where to look for it, what it is composed of, etc.

Scientific American No. 18, Volume CII **How to Make a Model of the Orbit of Halley's Comet, Showing its Relative Position to the Earth's Orbit.** Designed by James K Lynch. By means of this model many of the phenomena of Halley's comet can be explained.

Scientific American Supplement No 1772. **Photographing Comets.** By E. E Barnard, of Yerkes Observatory A practical article on how to photograph Halleys comet.

Scientific American Supplement No. 1778. **Halley's Comet.** An article in which the suggested observations proposed by the Astronomical and Physical Society of America are given, so far as photography and spectroscopic observations are concerned

Scientific American Supplement No 1782. **Halley's Cometary Studies.** Halley's own account of his investigations on orbits.

Scientific American Supplement No. 1785. **Halley's Comet as Seen from the Earth** A table prepared by the distinguished Greenwich astronomer, P. H. Cowell, giving the ecliptic co-ordinates of Halley's comet to two decimal places at intervals of four days through an arc extending from one end to the other of the latus rectum of its orbit. The figures apply approximately to any return

Scientific American No. 10, Vol CII **Could the Earth Collide with a Comet?** An examination of past comet scares and the general possibility of collision of a comet with the earth.

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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

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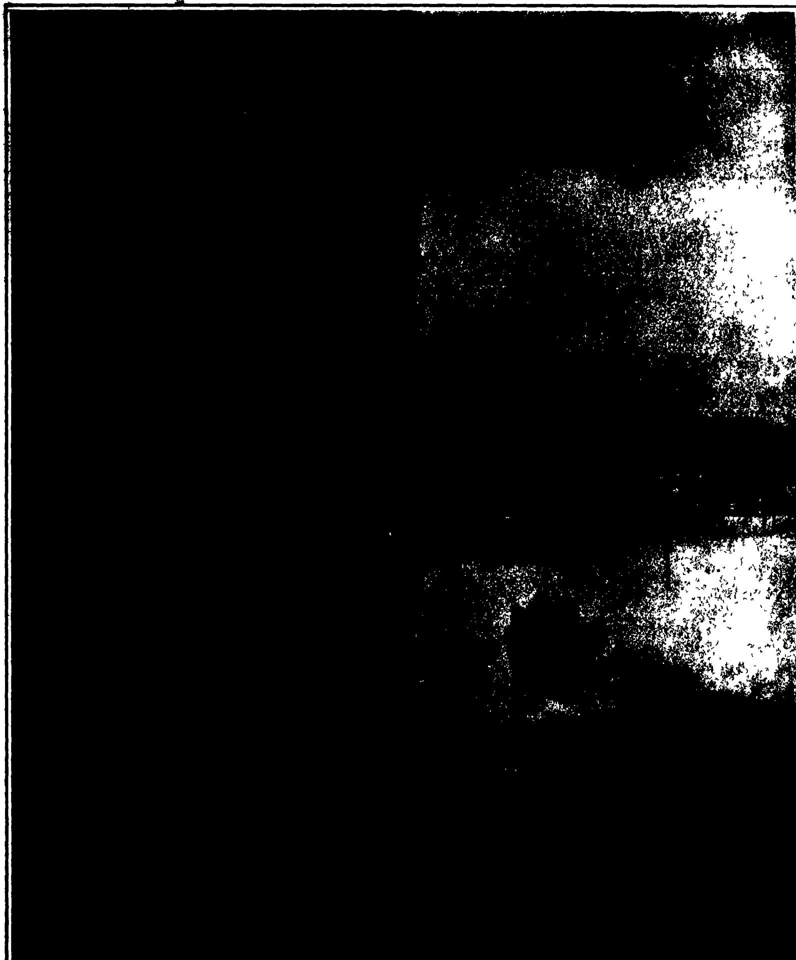

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

NEW SKYSCRAPERS FOR OLD

UNDER modern industrial conditions things are done in a big way and often with a strong dash of the spectacular. But the city dweller, albeit he is daily confronted with the unusual and the unexpected, must confess to some measure of surprise on learning that a modern skyscraper 300 feet in height, and but a dozen years old, is to be torn down to make way for a new structure which is to be several stories higher, and—more up-to-date! If you please. To the conservative European, the ruthless demolition of a building that must have cost over a million dollars and is still entitled to be called new, will appear, no doubt, as another instance of our national vice of extravagance. But it is not so. The Gillender building is being razed in accordance with a certain industrial doctrine, which has been found to give most excellent economical results, namely, the doctrine of the scrap heap, according to which we believe and have proven in a thousand ways that as soon as the march of improvement or development renders it certain that there is more profit in scrapping an existing machine, plant, or building, and replacing it by another more efficient or of greater capacity, it is a matter of sound business policy to send that machine to the junk heap, or turn the "wrecking gang" loose upon that building.

The policy is purely utilitarian—brutally so, if you like—a mere question of dollars and cents, but it is a good business policy nevertheless, and, in reality, has been one of the most powerful factors in bringing about the present phenomenal industrial development of the United States.

Your old-world engineer or architect, with perhaps a stronger flavor of sentimentalism, hesitates to sweep a faithful servant so remorselessly out of the way. He will point with pride to his forty-year-old locomotive with its million-mile record of service, and he will add wing to wing and another story or two to a building, if this be possible, rather than raze to the foundations and build from the ground up. It is a case of each to his choice, though there are not wanting many indications that British engineers are beginning to realize the value of the scrap heap, and apply the principles which it implies in the development of their industrial enterprises.

The Gillender building, which stands at the north-west corner of Nassau and Wall streets, in this city, is a sixteen-story steel-frame office building which was completed in 1898. The construction was first class, the foundation being put down by the pneumatic process, and the steel frame thoroughly braced to resist wind and racking strains. From street to cornice the sixteen stories extend for a height of 241 feet, and the picturesque three-story tower above brings the total height to about 300 feet. The exterior of the building is faced successively with granite, limestone, and terra cotta. Examination has shown the structure to be in as good condition to-day as when it was put up; and engineers and architects will be greatly interested as the steel frame is uncovered to observe how much, if any, oxidation of the inclosed steel work has taken place. In all probability, judging from the condition of the steel work of other composite buildings which have been demolished, such, for instance, as the Pabst building, removed a few years ago to make way for the New York Times structure, no rusting will have occurred that is worthy of mention. The removal of the Gillender building, while it will not probably bring to light any new facts regarding the behavior of inclosed steel columns, will strongly establish the conviction (should everything be found intact) that if the steel work be thoroughly painted at the mill, at the shops, and before it is inclosed in the building, it is absolutely proof against rusting and will remain intact and serviceable as long as the inclosing walls and roof endure.

Outside of rusting, there is no other known agency that tends to shorten the life of the steel frame of the modern skyscraper. Exploded long ago was the theory of the fatigue of metal. Simple statical stresses or even dynamical stresses of frequent repetition do not necessarily shorten the life of steel structures. It is only when these repeated stresses approach the elastic limit that the strength of the metal is imperiled—and in the modern skyscraper no such conditions exist. Certain imaginative magazine writers to the contrary notwithstanding, the visitor to New York five hundred or a thousand years hence will find the skyscrapers of to-day in perfect condition, provided, of course, that the doctrine of the scrap heap above referred to has not called for their demolition.

OUR NAVY AS A NATIONAL INSURANCE

AT the recent launch of the "Florida," as the great ship was starting down the ways, one of the crowd was heard to remark: "What a shameful waste of public moneys it seems when we think that this $10,000,000 ship may never be employed in the work for which she was built, and that if she ever gets into a fight, she may be sent to the bottom within a few minutes of the opening of an action." The remark was characteristic of much that is being said and written on the subject of the wastefulness of modern armaments. Taken by itself it would seem to be convincing, but if we look at the question broadly, and with that just sense of proportion which is necessary to a correct estimate of the value and meaning of things, we shall see that such talk is the purest sophistry. The costliness of a battleship must be judged in relation to what it stands for and the work which it is intended to do. In the last analysis the "Florida" is one element in an economical system of national insurance, designed to protect both the lives and the property of the ninety millions of inhabitants of the United States.

The true test of the question of the extravagance of naval expenditures is to determine the ratio that they bear to the money value of the property which they protect. The following estimates of expenditures, which have been furnished from Washington, show that the first cost of the ships of the navy, as they float to-day, is roughly $400,000,000, while the current annual expense of their maintenance is about $44,000,000. The cost of maintenance last year, including pay of officers and enlisted men of the navy and marine corps, pilot dues, provisions, clothing, ordnance equipment, medical and machinery stores, including coal, water and other incidentals, amounted to nearly $38,000,000. The cost of repairs to the hulls, machinery and equipage of the vessels amounted to more than $6,000,000, making the combined expense of preserving peace on our shores nearly $44,000,000.

The amount involved covers the expenses of all the various types of our ships of war, which include battleships, armored cruisers, cruisers, scouts, the torpedo flotilla, monitors, gunboats, supply ships, hospital ships, colliers, converted yachts, tugs and receiving ships.

As an example of the heavy expense of maintaining a big ship of war, we may take the battleship "Connecticut," which was the flagship of the Atlantic fleet during the last year. The pay of the officers and enlisted men of the navy and marine corps attached to the vessel and the expenses incidental thereto amounted to nearly $800,000. This did not include the cost of the necessary repairs.

The home fleet, or the vessels attached to the Atlantic side of the country, last year consisted of sixteen first-class battleships, which were divided as follows: six of the "Connecticut" class of 16,000 tons, five of the "Georgia" class of 14,500 tons, the "Idaho" and "Mississippi" class of 13,000 tons each, the "Missouri" and "Ohio" of 12,500 tons each, and the "Wisconsin" of 11,500 tons. The average cost of keeping a vessel of the "Georgia" class in commission and on active service, which did not include repairs, was nearly $680,000, while that of the "Idaho" and "Mississippi" class was nearly $530,000 each. The average cost of the "Missouri," "Ohio," and "Wisconsin" ran close to the $600,000 mark for all three. While these figures will vary for the same ships in different years, the cost of maintenance will not change much from year to year for the same class. The total cost of keeping these sixteen battleships of the Atlantic fleet in active service last year amounted to more than $10,500,000. It costs just about as much to keep an armored cruiser in active service as it does a first-class battleship, as is evidenced by the fact that the ten armored cruisers which were in commission last year cost the United States $7,000,000. Of these cruisers in commission, six were of the "West Virginia" 13,680-ton class, and the other four of the "Montana" 14,500-ton class.

With the increase in size of the battleships, there is a corresponding outlay for pay of the personnel, stores, maintenance, and repairs. The latest battleships to be placed in commission, the "Michigan" and "South Carolina," each of 16,000 tons displacement, will require crews of more than 50 officers and more than 800 men each. After these are ready, the "Delaware" and "North Dakota," each with 20,000 tons displacement, and each requiring 53 officers and 878 men, will be placed in commission. These will be followed by the "Florida" and "Utah," each of a normal displacement of 21,835 tons and each requiring 60 officers and 954 men, while the 26,000-ton "Arkansas" and "Wyoming," contracted for last fall, will each require a crew of 85 officers and over 1,000 men.

Now there is no denying that these expenditures, considered by themselves, are enormous, but when they are measured up against the vast national wealth in whose interest they are incurred, they sink into positive insignificance—and our navy is [illegible] to be the least costly, as it certainly is the [illegible] effective, institution in that scheme of national [illegible]ernment which is designed to protect the lives [illegible] property and to further the happiness of the p[illegible] the United States.

If the above seems to be a strong statement, [illegible] capable of easy proof. The latest estimate of [illegible] wealth of the United States available in the Bureau of Statistics is that of 1904, made by the Census Bureau, which put the total for that year at $107,104,[illegible]917, or $1,310 per capita. The 44 millions which the navy cost last year may be regarded as the cost of insurance against damage and loss of that 107 billions, and as such, it represents a premium of only four one-hundredths of one per cent. If we include the interest on the capital cost (400 millions) of the existing fleet, the premium is only six one-hundredths of one per cent, while the cost of the "Florida" ($10 millions), which loomed so large in the eye of the captious critic at her launching, dwindles to one one-hundredth of one per cent of the wealth of the country.

THE UTILIZATION OF SOLAR HEAT

IF the heat of the sun's rays were entirely converted into mechanical energy, it would furnish more than two horse-power for each square yard of surface exposed to the sun, but in practice it is difficult to utilize solar heat. Attempts were made in France by Mouchot and Tellier in 1871 and in Sweden by Ericsson in 1883. Mouchot and Tellier used a conical mirror to concentrate the rays upon a boiler containing water or other volatile liquid, but the mirror was costly and it gave only one horse power for 12 square yards of reflecting surface. Tellier, in 1885, caused the sun's rays to be absorbed directly by a lamellar boiler, containing a thin layer of water or more volatile liquid, such as ammonia or carbon disulphide. The same method has been recently employed by Shuman and Wiltsee in America. Shuman employs the steam generated to drive a low pressure turbine. The boiler is constructed upon the principle of a greenhouse, i. e. on the property which glass possesses of transmitting the sun's rays but stopping the return of thermal radiation from the interior. The boiler is a large vat coated with pitch and containing a layer of water three inches deep. An apparatus of this sort was operated in Philadelphia in 1907-1908.

Wiltsee also employs a lamellar boiler covered with glass, but the water heated in this boiler is used to vaporize the more volatile liquid ammonia or sulphur dioxide, the vapor of which performs a closed cycle. In California an apparatus of this kind with a boiler of 120 square yards of heating surface, furnished a mean power of 15 horse-power. Wiltsee estimates the cost of the apparatus at about $1.50 per square yard and calculates that it should absorb, at the 34th parallel of latitude, about 4,000 calories per square yard per day. With these data about 50 square yards would furnish one horse-power and would cost $80. For a large plant of 400 horse-power, however, the total first cost per horse-power would be doubled. The cost of operation is about 3/5 cent per horse-power-hour.

In experiments made at the agricultural station of Lausanne, Switzerland, for the purpose of determining the effect of potash fertilizers upon natural meadows, two neighboring fields having almost identical soils of glacial marl, showed a marked difference in effect and very curiously, the soil of the field that had yielded the larger crop was found, after harvest, to contain more potash than that of the other field. This remarkable result has been traced to the influence of drainage. The better drainage of the field which yielded the larger crop promoted the circulation of air and water in the soil, favored the assimilation of soluble nutriment, and caused the roots to extend to a greater depth and utilize a larger volume of earth. This example shows that the fertility of a soil cannot always be determined by chemical analysis alone.

ENGINEERING.

Reinforced concrete continues to widen the range of its application. The Western railroads are preparing to build this summer long stretches of reinforced concrete snow sheds. These will not only be stronger than the present timber structures, but they will be entirely safe from the menace of fire

The independent gasoline-driven railroad motor car, which we have frequently illustrated in this journal, is growing in favor A new car, 70 feet in length, recently left the shops at Omaha for the Buffalo, Rochester and Pittsburg Railroad This is the seventy-fourth car of the type to be turned out from these shops, and it is the sixth car to be built for service east of the Mississippi River

The ever-increasing weight of Western passenger trains is being met by a steady growth in the size and power of the locomotives. The Chicago, Milwaukee & St Paul have recently turned out of their shops two types of six-coupled simple locomotives, with cylinders 23 inches by 28 inches, one of which has 69-inch drivers and a tractive effort of 31 900 pounds, and the other 69-inch drivers and a tractive effort of 500 pounds.

An electrically-operated pile driver is described in a recent number of the Electrical Review and Western Electrician The apparatus, which is of English make, is provided with a revolving frame and swivel leaders. Instead of a mechanical device for gripping the monkey, an electro-magnet is used, the top of the monkey being planed off smooth to provide a good contact surface An electric motor is used for operating the hoisting crab The circuit of this motor includes the magnet, and the switch for the latter is attached to the crab

An important paper on oils used for switches and transformers was recently read at the Manchester session of the Institution of Electrical Engineers. It was pointed out that very little attention has been paid to the quality of the oil used in this way, and that any impurity in the oil would reduce its resistance to a flow of electric current, also that the specific resistance at different temperatures varies with the grade of the oil Careful investigation of this subject was urged with a view to obtaining oils of standard resistance values.

In a recent lecture before the Engineers' Club in New York, Mr Elmer A Sperry, the electrical engineer, demonstrated with a working model the value of his "active" gyroscope If the ordinary, or "passive" gyroscope be applied to ships, the vessel must roll some 2½ degrees before the counteracting influence is exerted In the new type the least tendency toward a roll sets in operation a governing device, consisting of a smaller gyroscope, which starts the larger gyroscope, and thus secures an instant and absolute stability Mr Sperry believes this new type will provide the gunner with a perfectly stable platform

America will be represented this year in European yacht racing by the large and powerful two-masted schooner, "Westward," which has been built by Herreshoff for A S. Cochrane of the New York Yacht Club The "Westward is the largest American racing schooner yet sent across the Atlantic She is of 197 tons gross, as compared with the "Ingomar," of 142 tons, also built by Herreshoff, which a few years ago made a brilliant record in English and German waters She will meet the big German schooners "Meteor and "Germania," and probably one or two English built schooners of less size, but of proved speed and ability

According to A. A C Swinton, the first flight of a model aeroplane propelled by steam is to be credited to the Hon Charles A. Parsons of turbine fame, who in 1893 built an aeroplane with two 11-foot wings and a tail, and drove it with a steam engine whose cylinder was 1¼ inches diameter by 2 inches stroke, steam being supplied by a boiler 2½ inches diameter by 14 inches long, in which steam was generated at 50 pounds pressure by a spirit lamp The whole apparatus, including aeroplane, engine, and fuel, weighed 4¾ pounds, and it flew for distances of 100 yards at a height of 20 feet, coming down only when the steam pressure fell

We have been favored by Mr George Westinghouse with the following particulars of his new reduction gear high-speed marine turbine. The rotor complete will weigh about 1½ pounds per horse-power in sizes of from 3,000 to 1,500 horse-power The number of blades of all kinds in a turbine of from 7,500 to 10,000 horse-power will be slightly under 15,000. The total weight of the turbine with rotor will not exceed 7 pounds per horse-power, and the weight of the gearing will be under 2 pounds per horse-power The effect of this reduction of weight is seen in the new naval collier, No. 8, which will carry 300 tons more coal than if she were driven by reciprocating engines, A saving of an additional 800 tons will be realized as the result of the greater economy of the plant in fuel consumption.

ELECTRICITY.

The conditions under which a street lamp should prove its efficiency are very different from those which govern the indoor lamp. This was brought out clearly in a recent address before the New York Section of the Illuminating Engineering Society by Dr Clayton H. Sharp. He pointed out that while in the building it is advantageous to have much of the light of a lamp pass upward and be reflected by the ceiling in the case of a street lamp this would be a great fault for the vertical rays would be lost Only those rays that are cast directly downward and horizontally up and down the street can be utilized For this reason he has devised a reflector consisting of a pair of parabolic mirrors arranged to throw the rays in the direction of the street so that practically all of the light will be used to best advantage Thus, in place of having the street lighted in spots, as is now the case, a more continuous illumination is provided

The block signal systems of steam railroads have hitherto been operated with direct current from storage batteries. This has always been an expense owing to the inconvenience and difficulty of maintaining the storage batteries In recent times trolley roads have been using an alternating current signal system which has been found to work very satisfactorily, and the announcement has just been made that the Pennsylvania Railroad is about to install an alternating current block signal system on the line between Dixon, Ohio, and the Grand Rapids and Indiana Railway This is probably the first instance of the use of alternating currents for steam railroad signaling purposes and if found satisfactory should do much toward extending the use of block signals on lines where the direct-current system is impracticable

In an article appearing in a recent number of the Electric Railway Journal some very interesting conclusions were arrived at concerning the question of the cost of a street-car ride The nickel surrendered for say, a three-mile ride in a street car is the very cheapest investment a man can make for covering this distance Certainly any other method of transportation would be far more expensive and even the man who walks to his work, if he is earning 15 cents per hour would consume at least 10 cents worth of time instead of the 5 cents spent on the street car In addition to this, the nickel surrendered to the street-car company is an insurance to him against accident while if he rides in an automobile or even if he walks to his work, he would be obliged to pay all damages in case of accident Furthermore the time spent on the street car can be employed in reading business documents or doing other such work

In view of the recent agitation in favor of using electric headlights on locomotives, the experiments along this line by Prof Benjamin, of Purdue University, are most interesting Prof Benjamin has found much to be said against the electric headlight Not only does the strong beam of light blind engineers on locomotives coming from the opposite direction but it also has a peculiar effect of producing false signals In one of his experiments the light of a green signal was extinguished, but when the beam from the electric headlight fell upon the green roundel, it was powerful enough to reflect a green light which appeared to the engineer to be a caution signal This effect persisted until the engine was within four hundred feet of the signal On the other hand in favor of the electric headlight it has been pointed out that obstructions on the track are readily seen far enough off to permit of stopping the train before they are encountered Furthermore, on a single-track line, the presence of a train may be detected at a long distance off, and head-on collisions may thus be prevented

Considerable attention has been directed of late to the injurious effect of certain rays of electric lamps upon the eye A very interesting communication upon this subject was recently presented by Dr Stockhausen before the Illuminating Engineering Society of London, and he pointed out that an excess of radiant energy, no matter what its wave length is injurious. Hitherto it has been supposed that the red and infra-red rays on account of their heat value, are very injurious to the retina, but Dr Stockhausen does not believe that under ordinary conditions the effect of these rays is very disastrous Certainly in sunlight, these rays may be found in large quantity The best rays for the human eye are the yellow-green rays. The rays from blue to deep violet do not appear to produce serious effects, and even the rays in the ultra violet section of the spectrum do not do very much damage The really injurious rays appear to be those which belong in the extreme ultra violet section. These rays are not found in ordinary sunlight, but appear in the light produced by quartz-inclosed mercury vapor lamps As ordinary glass is opaque to these rays, it is a simple matter to avoid them.

SCIENCE.

A telegram has been received at Harvard College Observatory from Prof. H H Campbell director of the Lick Observatory, stating that "Frank McClean cables from Hobart, Tasmania, steady rain, eclipse invisible "

A new inflammable celluloid has been patented by Prof A Gautier The chief feature of the process is the employment of an ether silicate instead of pure ether, which is ordinarily used with alcohol as the solvent in the agglutination of nitrocellulose fibers by means of camphor

The University of Paris and the Pasteur Institute have been authorized to conduct jointly a laboratory of radio-activity located in Paris. This new laboratory will be divided into two sections, one of which is reserved for scientific researches under the direction of Madame Curie while the other will be devoted to medical applications of radio-activity and is placed under the direction of the Pasteur Institute

What does "gold filled" mean? Probably most people who buy gold filled watches fancy that they are mysteriously impregnated with gold As a matter of fact, the term is misleading Gold filling consists in taking two sheets of gold between which is placed a section of solder-coated base metal This metallic sandwich is heated and pressed so that the three parts are welded together with the gold outside

Dr E E Barnard of Yerkes Observatory informs us that despite the haze and clouds of the early morning of May 7th, 1910 he obtained fair photographs of Halley's comet A tail about 20 deg long appeared on the photographs To the naked eye it was only 17 deg or 18 deg long The head was of the second magnitude On one picture the tail showed separately in three strands, some five or six degrees from the head The comet was a beautiful object on the mornings of May 4th and 5th

In a recent bulletin issued by his observatory Mr Percival Lowell describes his newly-discovered Martian canals These new canals are two in number and were discovered on September 30th 1909, to the east of the Syrtis Major where no canals had ever previously been seen They were most conspicuous Not a trace of them could be found in the record drawings of August July, June or May when this part of the planet was depicted nor could any trace of them be found in the records of previous years Mr Lowell admits the possibility that the phenomenon might be one that could have been seen before but was not yet the possibility of error seems excluded by the size of the canals in question He regards the evidence as strong that the canals are not simply new to us, but new to Mars Measurement of their dimensions shows each of them to be a thousand miles long and some twenty miles wide The Canyon of the Colorado would be a secondary affair in comparison

Light is of very great importance to algæ growing on the sea bottom and in their struggle to obtain light the plants assemble in structures of several stories The algæ of the genus *Laminaria* adhere to the rocks by means of disks The wounds made in the plants by the attacks of animals become covered with a protective secretion in which the countless spores which the sea water contains become entangled and grow This layer of epiphytes is covered in a similar manner by a second layer of plants or of sessile animals the shells of which are again covered with algæ In addition to these variegated structures in which saprophytes and parasites have their place fragments of algæ which have been torn by winds currents and animals take root upon other algæ and form structures of several layers For example the delicate *Ectocarpus* grows on *Laminaria* and is soon covered by the broad root disks of *Rhodolymenia* which are sufficiently transparent to transmit to the *Ectocarpus* sufficient light for its development

The mineral waters of Vichy Clermont Ferrand, Mont Doré and Spa contain fluorescent substances in very minute quantities The quantity of fluorescent matter often increases with the temperature of the water and diminishes as the amount of solid residue increases At Spa the amount of fluorescent matter has been diminished by improvement in piping The largest proportion is found in waters containing tarry constituents These results are of practical interest in connection with the piping of mineral springs Nearly all natural waters whether potable or contaminated contain organic substances which are already fluorescent and others which become fluorescent when the water is heated to 266 deg F for half an hour The development of fluorescence is promoted by the addition of five per cent of ammonia All such waters exhibit increased fluorescence when they are heated but this change is not produced by heating the water of a properly piped mineral spring because this water has already been exposed to a temperature of at least 266 deg F in the earth, and a second heating does not affect the fluorescence

COMET NOTES.

The Lowell Observatory has issued a bulletin entitled Preliminary Notes on Photographic and Spectrographic Observations of Halley's Comet The observations consist principally of direct photographs of the comet and photographs of its spectrum as seen at Flagstaff Halley's comet before April 18th had shown no very striking changes, except in the divergence or separation of the lateral streamers Negatives obtained on April 25th and 27th show marked changes in the form of the tail On the 25th the tail, at a short distance from the head divided into three narrow streamers a central ray and two symmetrical side branches On photographs made on the following morning the tail was again quite narrow and straight On the 27th it was again branched The most remarkable changes noticed at Flagstaff in the comet's tail were observed on photographs made on April 30th and May 1st On April 30th the tail had completely changed in form The more or less bilateral symmetry had entirely disappeared The plates of May 1st show for a distance of about 70 deg a tail well defined with a gentle curvature, but beyond this point faint and diffuse The outer parts of the tail on the last two plates have the appearance of having been acted upon and shattered by some rather sudden and disturbing disintegrating force The comet's nearest approach to Venus occurred about this time The question naturally arises, could the planet have been the disturbing influence? Comparisons of the disappearance of the comet's tail for some days before and after this event may tell us something

The great square of Pegasus acted as a splendid 'finder' both for the comet of 1910 A and for Halley's comet This mutual association of the two comets with Pegasus affords a good example of one of the chief difficulties experienced by those astronomers who have endeavored to trace Halley's comet amid the mass of brief and very general records of comets in ancient chronicles

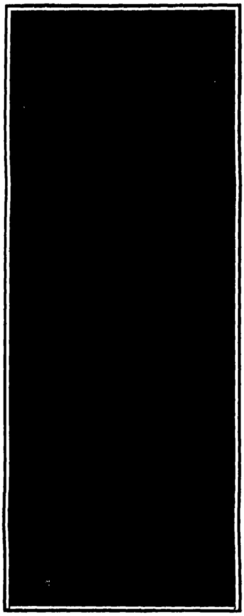
It is unfortunate that the chance of capturing a sample of the tail of Halley's comet was not seized The passage of the earth through a comet's tail is so rare an occurrence that no opportunity should be missed In the April number of the Bulletin de la Société Astronomique de France, C E Guillaume suggested the liquefaction of a large quantity of air which could afterward be treated by fractional distillation, and possibly some cometary matter recognized He pointed out that very minute quantities of the rare gases, such as krypton and argon, are thus secured from immense volumes of air and that it is now possible to liquefy 1 000 cubic meters of air per hour It is just possible that by this means a chemical study of the comet might become a by product of an industrial operation

An investigation of Encke's comet by Dr Backlund shows that the acceleration of the mean motion of that body between 1895 1901 and 1904 was not constant Dr Backlund suggests that the resistance which would explain the phenomenon is a meteoric swarm in the neighborhood of perihelion, and that the decrease of the acceleration must be attributed rather to the diminution of the density of the resisting medium than to changes in the comet itself Dr Backlund also discusses the comet's fluctuations in brightness, but offers no explanation

The passage of the earth through the tail of Halley's comet has led Flammarion to suggest that if there is any palpable material at so great a distance from the head it might be possible to measure the minute rise of temperature produced by the earth as it rushed through the tail at the rate of 48 miles a second

Although comet A 1910 has sped away its peculiarities are still the subject of astronomical comment Thus Dr Wolf comments upon a conical mass of material extending from the base of the coma toward the sun, quite different from anything seen in previous comets, and having the appearance of a miniature zodiacal light.

It was to be expected that the apparition of Halley's comet would not remain without its effect upon the more ignorant peoples of the world, even though this



PHOTOGRAPH OF HALLEY'S COMET TAKEN BY DR. E. E. BARNARD ON MAY 5, 1910

is the twentieth century, and the days of superstition are supposed to have passed Reports from China state that the comet was used as an omen to inflame rioters in disaffected districts. To be sure, the authorities tried to counteract these attempts by exhibiting pictures of the comet with an account of its previous appearances without ill effects, in order to reassure the natives. This Chinese situation finds its counterpart in Europe. The suicide of a Hungarian farmer "on account of Halley's comet," as the newspapers have it, is followed by a report from Odessa that in Southern Russia there is a veritable popular terror which is being exploited by unscrupulous persons for the purpose of obtaining money for special prayers, etc.

Observations of Halley's comet made in Harvard College Observatory on the morning of May 6th lead to the following results The brightness of the nucleus of the comet was measured by Prof Wendell with the 15-inch equatorial, with the resulting magnitude 7 06 The nucleus was, therefore, distinctly fainter than on April 27th, when its magnitude was 6 01. The total light of the comet was greater, being estimated by Mr Campbell as magnitude 2.2 Three photographs were obtained by Mr King which showed a well-defined nucleus. A long tail was shown, which was bifurcated

THE ACCIDENT TO THE "ZEPPELIN"

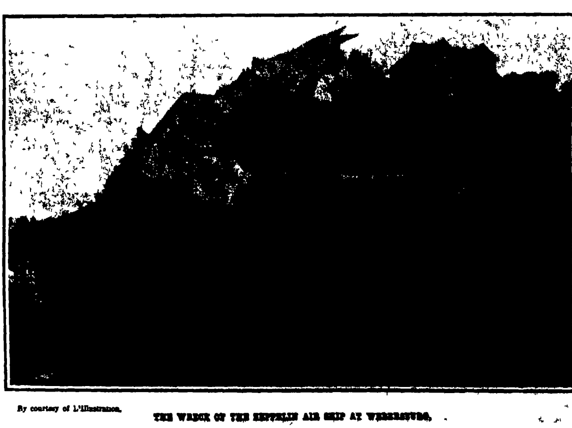
The recent destruction of the "Zeppelin" airship again drives home the inherent defects of the rigid type of airship While journeying from Homburg to Cologne, it was necessary to anchor the airship in an open field. On April 25th, at 1 P M, after the vessel had received a new charge of gas, it was torn from its anchor by a storm, and driven away in a northwesterly direction The airship came down at Webersburg in the vicinity of Weilburg on the River Lahn, and was totally destroyed Two companies of soldiers were unable to hold the vessel against the terrible storm In order to prevent a catastrophe, it was necessary to order the soldiers to release the airship, which immediately rose to a height of 700 feet, and was driven away in the direction of Weilburg At 20 minutes past one the airship was sighted from Weilburg Suddenly, probably caused by a downward gust, the vessel was forced down into the Lahn valley In the Lahn valley, where the storm raged violently, the wind blew the vessel broadside and pressed it down to the earth The nose dipped almost into the Lahn, which winds through the valley Then the bow of the "Zeppelin" was caught in the telegraph wires which run along the railway. The metal frame was twisted Trees were bent and telegraph poles were torn down, and with a frightful noise the wind hurled the enormous gas bag against the side of a hill and forced it into the trees. Another gust of wind then threw the lower portion of the airship across the hill Aluminium parts, yards of balloon cloth, and steel rods lay in a tangled mass

The catastrophe of Weilburg is the fourth sustained by dirigible airships The first was that of the French dirigible "La Patrie," which during a trial at Verdun on the 29th of November, 1907, had to land in the vicinity of Suesnes The next morning, the wind changed to a howling hurricane. The soldiers who were in charge of the airship were compelled to release the ropes in order not to be carried away In a few minutes the "La Patrie" had vanished, and was never seen again

The next great catastrophe destroyed the "Zeppelin IV.," while Count Zeppelin was on his famous 24 hour record trip of the 4th and 5th of August, 1908 On the return journey about ten kilometers from Stuttgart, Count Zeppelin was compelled to alight at Echterdingen to make repairs. Even before it was possible to cure the defects in the motor, which had caused him to come down, the airship was destroyed To this day the actual cause has not been discovered. The "Zeppelin" caught fire and was burned up in a few minutes.

The next catastrophe affected the French dirigible "Republique." The destruction of the "La Patrie" and the

(Concluded on page 427.)



By courtesy of L'Illustration.

THE WRECK OF THE ZEPPELIN AIR SHIP AT WEBERSBURG.

THE THORNE-BAKER TELE-PHOTOGRAPHIC APPARATUS

AN INSTRUMENT FOR TRANSMITTING PICTURES WITH AND WITHOUT WIRES.

On the evening of May 11th, Mr T Thorne-Baker delivered a lecture before the New York Electrical Society, in which he explained a new tele-photographic apparatus, of his invention The apparatus is to be experimentally tried out in transmitting newspaper pictures between New York and Boston It has been used by the Daily Mirror of London, between Paris and London, and Manchester and London since July, 1909 With some modification, it can be adapted to the wireless transmission of pictures.

Mr Thorne-Baker's apparatus employs no selenium cells and prints the records electro-chemically A print is made from a photographic negative in sensitized fish glue on lead foil The print is made in the usual way, and the parts not acted upon by light are washed away, as in the gelatine process of photography This impression is wrapped around a drum somewhat similar to the drum of an Edison phonograph The receiver consists of a similar revolving metal drum, over which a platinum stylus traces a helical line on a paper impregnated with some colorless electrolyte, the nature of which is not revealed Whenever the transmitter of the stylus touches a clear part of the metal foil, current flows to the receiver, and a black or brown dot or mark appears on the chemical paper The accompanying diagram illustrates the general arrangement of the apparatus

The lead foil picture is broken up into thin and thick lines with spaces intervening The stylus touches the lead base or the fish glue lines, and the time of contact depends upon the width of the line Hence the width of the lines determines the periods of the line currents.

The apparatus is used over a telephone line, the circuit being closed by the two styles S_1 and S_2 with two batteries B_1 and B_2, and the split resistance W_1, W_2 of 1,000 ohms, in shunt. The variable condenser K is shunted across the variable contacts of the resistances, and the currents used to sweep out the residuary charges are regulated with the aid of the resistances W_1 and W_2. These line currents flow through the chemical paper on the drum, but the pole of battery B_1 connected with the style S_2, is of opposite sign to that of the line unit connected with it When the leakage on the line is great and evenly distributed, less reverse current is required from the balancer (a device employed to wipe out residuary currents from the line in the way frequently made use of in duplex telegraphy) By increasing the voltage of the reverse batteries B_1 and B_2, considerably greater contrast can be obtained in the pictures. The finer the half tone screen employed in splitting the half tone up into lines, the higher must be the voltage

In all tele-photograph apparatus the problem of synchronism is one that has always bothered the inventor The best arrangement is that of Korn whose system has been adopted by most recent designers, as well as by Mr Baker The motors, driven through storage batteries at about 3 000 revolutions per minute, are geared down for the drums to 30 revolutions. The speed of each motor is regulated by resistance in series to the field, and the speeds are observed with the aid of vibrating reed frequency meters. A set of tuned steel tongues is fixed in front of a magnet which is fed with alternating currents from slip rings on the motor Each tongue has a different period of vibration, and when the alternations in magnetization correspond with the period of one tongue, that tongue will vibrate The receiving drum is driven somewhat more quickly than the transmitting drum, and, therefore, completes its revolution somewhat before the transmitter It is then stopped by a steel check. When the transmitting drum has completed its turn, a fleeting contact comes into play; a reverse current is sent to the receiver, which flows into a relay actuating the electro-magnet by which the check is removed. Thus, whatever lag there may be is limited to one

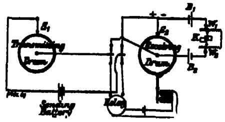


Fig. 1.—General arrangement of the apparatus

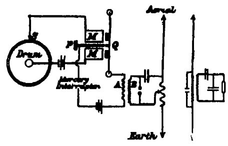


Fig. 2.—Apparatus for transmitting pictures wirelessly

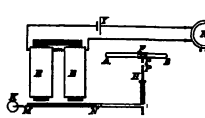


Fig. 3 -Relay employed in the wireless apparatus.

drum, and the drums are always re-started in unison

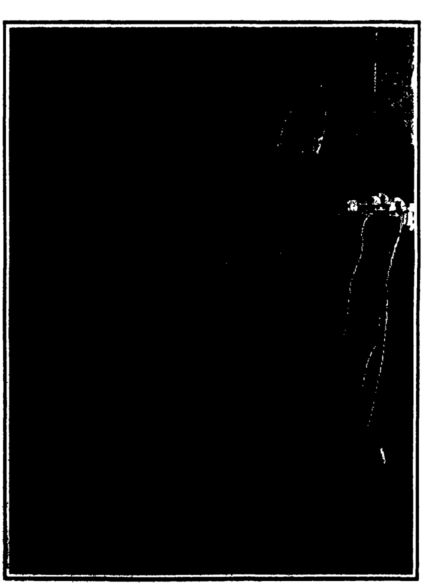
One advantage of Mr Baker's system is to be found in the fact that the entire operation of transmitting and receiving occurs in full view It is not necessary to develop a picture before discovering whether anything is wrong with the apparatus. Furthermore, the transmitting cylinder can be used as a receiving cylinder, if necessary

The ordinary two-station instruments fit into two boxes of moderate size A portable apparatus, however, has been devised by Mr Baker, which he claims can be carried from place to place by an operator, so that pictures can be prepared in the field and telegraphed on Thus plans, positions of troops and of ships can easily be transmitted

Perhaps that feature of Mr Baker's researches which will interest the readers of this journal most is the adaptation of his apparatus to the transmission of pictures by wireless telegraphy The principles may thus be explained Conceive a small incandescent lamp, coupled with the local side of a relay and battery the relay being actuated by means of a coherer When a Morse key, closing the primary of an induction coil, is depressed the lamp glows until the coherer is tapped The taps can be controlled by the lines in a photograph or sketch and the light of the lamp can be concentrated on a revolving photographic film Mr Baker applies the principle in the manner shown in Fig 2 A line picture is attached to the drum of the transmitter, and the intermittent current ordinarily passed into the telephone line flows into the electro-magnet end The magnet M attracts the diaphragm Q and brings the platinum contacts $P\,Q$ together When they are in contact the primary of the transformer is closed, and the spark gap of the secondary, inductively coupled with the aerial and the earth, sends out oscillations Hence the length of the signals and their distance apart are regulated by the lines of which the photograph or drawing to be transmitted is composed

When working with currents of 110 volts, arcing must be prevented This is done with the aid of a mercury interrupter The receiving apparatus is simple and for a short distance involves the use of a coherer cymoscope of peculiar character Whenever the oscillation passes the antenna the coherer becomes conductive and a relay is actuated which starts a vibrating hammer In order that the hammer may strike only once for each signal the arrangement shown in Fig. 3 is employed The relay R actuates the electromagnet $E\ E$ which attracts the armature $M\ N$ This motion brings the resilient hammer H provided with the platinum contact P against the contact pin fixed to the collar F of the coherer $A\ B$ Thus the local circuit is closed, and a black mark appears on the chemical paper Successive marks can be obtained at intervals of 0 017 second Up to the present this device has been successfully used only for line drawings The apparatus however might be used for the transmission of sketches and plans Mr Baker suggests that military plans could be done in shellac ink on a slip of metallic foil placed upon a portable machine coupled to a military wireless set, and communications could thus be exchanged What is more such a communication cannot be tapped Even if the enemy were in possession of an exactly similar instrument of the same dimensions and screw thread the picture received will be quite confused if the rate of running is altered by five or ten per cent, according to prearranged signals

A special form of Einthoven galvanometer is employed by Mr Baker for working the relay which galvanometer has a very intense magnetic field Instead of the usual silver wire a silver quartz fiber one twelve hundredth of an inch in thickness is employed This galvanometer is combined with the valve receiver for detecting wireless oscillations recently invented by Prof Fleming When the rectified currents which in ordinary radio-telegraphy cause the telephone to sound, are sent through the silver quartz fiber the string is shifted The shadow of the string lies over a fine slit, which is thus opened by the oscillations In order to be able to use



MR. THORNE-BAKER AND HIS TELEPHOTOGRAPHIC APPARATUS.

a wider slit Mr Sanger Shepherd has fitted the apparatus with a fine shutter, and in that case the receiver can be modified The beam of light is then directed through the tunneled poles of the electro-magnet, and a pair of narrow compensated selenium cells is placed behind the slit, a positive lens being interposed Any dot received shifts the fiber laterally, light falls on the selenium cells, and their reduced resistance allows a battery to actuate a relay which throws the telephotograph receiver into circuit

HOW THE "FLORIDA" WAS LAUNCHED

The launching of the 'Florida,' which took place strictly according to schedule, at the Brooklyn navy yard on the morning of May 12th, was an unusually brilliant function In its technical aspects the launch was particularly successful, and we offer our congratulations to the naval constructors who were directly responsible The ship is now tied up at the navy yard dock, where she will receive her side armor, which is already assembled at the yard, and her turrets which are also about ready for placing

A most interesting feature of the day was a dinner in celebration of the event, given by the employees of the yard who built the ship This event at which some 1 200 were present, included among the speakers Vice President Sherman, Governor Gilchrist of Florida Assistant Secretary Winthrop of the navy, Admiral Leutze, the commandant of the navy yard, Naval Constructor Baxter, and others. Capt Baxter referred to the strong personal interest taken by the whole force of men who worked upon the "Florida" in the success of the ship To the Editor, who was present as a guest, the genuine enthusiasm raised among the men whenever any reference was made to the ship, the yard, and its officers seemed to be a strong indorsement of the policy of having at all times a battleship under construction at the New York yard

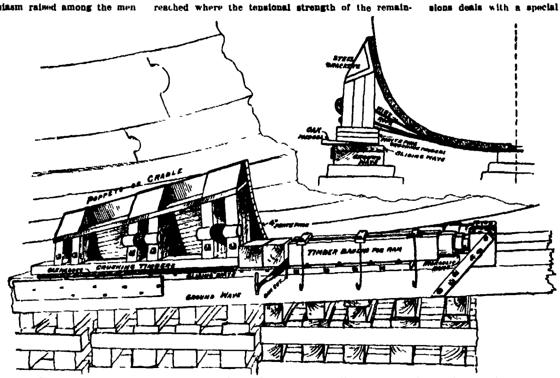
In response to several inquiries as to just how a battleship is launched, we have prepared the accompanying sketches, showing a portion of the launching ways near the bow The permanent or "ground' ways consist of rows of piling driven to a solid bearing upon which are spiked heavy, square timbers, or "caps,' running transversely Upon these are laid series of heavy, longitudinal square timbers in three parallel lines, one immediately beneath the keel, and one on each side of the ship between the keel and the bilges During construction the weight is carried upon the keel blocks and upon hundreds of shoring timbers. When the ship is ready for launching and a few minutes before the actual launch the weight of the ship is transferred from the central keel blocks and the shoring timbers to the two parallel lines of launching ways Each permanent way, built up of heavy, square timbers, presents a sliding surface four feet wide extending the whole length of the ship and down a considerable distance into the water The permanent ways are fastened firmly down to the cross caps and piling below The launching ways which are also four feet in width, are attached to the hull of the ship, and move with it down into the water Between the under surface of the launching ways and the upper surface of the permanent ways is a thick coating of grease, oil, and other lubricating substances. The launching ways have to be molded to the form of the ship for which they form a cradle, and our drawing shows part of the cradle near the bow, which is known as the forward "poppets." The poppets consist of six sets of 14 inch by 14 inch timbers in groups of half a dozen At their upper ends these timbers bed against heavy angle iron brackets, and at their lower ends they rest upon what are known as the "crushing timbers" long lines of parallel timbers four feet wide the bottom one of which forms the sliding surface of the launching ways The above-mentioned angle irons are riveted to steel straps from a half inch to three-quarters of an inch thick and 42 inches wide which extend down below the keel and up to similar brackets on the other side of the ship The space between the straps and the hull is filled in with four inch white pine timbers, which form the bed in which the bow of the vessel rests. To assist in tying the whole cradle together, heavy wire ropes pass beneath the bow and are carried around heavy oak thimbles, placed on the outside of the poppets. Further support is given by 1¾ inch tie rods, which are drawn up snugly by nuts on the outside of the poppets.

The crushing timbers are provided throughout their entire length with a series of oak wedges interposed between them and the launching ways below About half an hour before the launch, hundreds of workmen range themselves up and down the ways, and by means of heavy sledges drive these wedges home, forcing the launching cradle into closer contact with the ship, and eventually lifting it sufficiently to clear it from the keel blocks, thus transferring the load entirely to the launching ways.

This brings us to the consideration of the interesting method by which the ship is held in place, and prevented from starting off down its well-greased "toboggan" until the exact moment when the christening is performed and the order is given to let go The locking and starting gear are as follows

The hardwood launching ways are extended forward and strongly bolted down to the ground or permanent ways. After the wedges have been driven home, and the ship is resting on the inclined and well-greased surfaces it is prevented from moving solely by these bolted connections At the critical moment, at the word of command, carpenters armed with cross-cut saws commence to saw through these timbers, and as the cut is made, a point is soon reached where the tensional strength of the remaining timber fails to hold the vessel. It parts with a loud report, and almost invariably the ship starts, slowly at first, and then more rapidly, for the water

Occasionally a vessel will stick and must be given a start. For this purpose, four heavy ramming timbers are laid in position abutting against the end of the launching ways, with hydraulic jacks interposed between them, and heavy timber abutments. Should the ship "hang," a brief operation of the jacks is generally sufficient to start her



The upper end of sliding ways is bolted to the ground ways. To free the ship, the sliding ways are sawn through, when a push from the hydraulic rams (if necessary) sets her in motion

LAUNCHING WAYS AND CRADLE OF "FLORIDA" NEAR THE BOW

Reducing the Number of Appeals in the Patent Office.

Mr Frank D Currier of New Hampshire introduced on January 21st, 1910, a bill the principal purpose of which is to expedite the granting of patents in the Patent Office, and to eliminate one appeal in the office In his last annual report the Commissioner of Patents recommended such legislation and advocated a measure which would combine the Commissioner, the First Assistant Commissioner, the Assistant Commissioner, and the Examiners-in-Chief into a single appellate tribunal, any three of whom shall constitute a quorum, to which all appeals shall lie, whether from the Primary Examiner or from the Examiner in Interferences, and from which appeals would lie to the Court of Appeals of the District of Columbia.

Under the present patent law in *ex parte* cases an appeal lies from the Primary Examiner to the Board of Examiners-in-Chief, then to the Commissioner (the First Assistant Commissioner or the Assistant Commissioner), and from his decision to the Court of Appeals of the District of Columbia. In interference cases, the course of appeal from the decision of the Examiner of Interferences is the same. This course of appeals undoubtedly imposes an unnecessary amount of delay and expense, throws upon an over-burdened Commissioner the impossible task of giving to each case the amount of personal attention proper to its disposal, as demanded by law Lastly, the Board of Examiners-in-Chief, as at present constituted, consists of three members, and no provision is made under the present law to supply a temporary vacancy caused by sickness, or other cause, with the result that the absence of one member sometimes results in an unevenly divided Board, and in the consequent necessity for a rehearing The absence of two members causes an entire suspension of business.

The enactment of Mr Currier's bill into a law would provide an appellate Board, any three members of which would constitute a quorum, the prosecution of all applications on appeal would be expedited, and the elimination of one appeal would mean the saving to the inventors of one appeal fee, attorneys' fees and incidental expenses Lastly, one appeal in the Patent Office instead of two would give greater stability to the decisions of the office tribunals, and would also obviate any want of agreement that has at times existed in the past between the decisions of the Commissioner of Patents and the Assistant Commissioners.

The bill is in reality Commissioner Moore's bill, for it was submitted by him to the Secretary of the Interior, who made a careful study of it and transmitted it for the consideration of Congress. The patent profession, as a whole, is in favor of the measure

The value of the measure will be appreciated when we consider the manner in which the Patent Office does its work Each of the forty-two examining divisions deals with a special class of inventions. The Board of Examiners-in-Chief, consisting of three men at present, must deal with inventions from all of these forty-two divisions, covering the entire range of mechanical arts, chemistry, electricity, and the like The members of the Board cannot be experts in all of these widely diverging fields of activity They must inform themselves upon all these classes of inventions as they come before them They are supposed to have a special knowledge of all the legal points which are likely to be involved in the appeals on mechanical questions. They must study up and inform themselves so as to be able to explain the technical point at issue Obviously, in order that these men may keep up with the times, it is necessary for them to study and read much At present there are hearings every afternoon beginning at one o'clock There are on the docket seven or eight *ex parte* cases involving the patentability of an invention, or one to two interference cases involving the consideration of testimony taken on both sides, the application of the law, and frequently, the right of the applicant to make the claims. Hence, only the forenoon is left for study and what reading is necessary and the preparation of decisions. It is small wonder that the Examiners-in-Chief find it almost impossible to keep up with their work. Driven to it, they can make some sort of a decision, but to do so properly the invention must be studied thoroughly, and in interference cases the testimony must all be read, even though it may involve thousands of pages. With only three men on the Board, the time has come when it is necessary to do something in the way of relief, so that prompt and correct decisions may be handed down. Just now the Board is several months behind its work. The result is that to get an appeal through the Board of Examiners probably requires three to four months' time. The bill in question saves so much time in getting a case through the Patent Office It practically provides six men to do the work that three are now trying to do, without any additional cost.

At the present time, the same work is done over twice in the Patent Office for no very good reason. The theory of the present course of appeals is that under the decision of the present Board of Examiners-in-Chief, there will be an appeal to the Commissioner in person. It is impossible for the Commissioner of Patents in person to give due consideration to all

these things which are appealed to him. He has to have the help of his Assistant Commissioner, and he also has to have the help of law clerks. The situation is, therefore, this: Instead of getting the decision of the Board of Examiners-in-Chief, the only chance the Board has of getting together and forming an opinion on a case is after hearing the arguments which are made by the attorneys. The Board then tries to come to some conclusion at that time If it does not, then the work is to be divided among the members of the Board, and each one has to prepare his share of the cases, and then explain his decision after it is rendered to the other members of the Board, whereupon they decide whether they will concur or dissent Obviously, the decision does not exactly represent the views of all the members of the Board. Sometimes they have so much work to do that they have to pass it over and sign it any way

For these reasons, it would seem that the Currier bill is worth enacting into a law

A PHENOMENAL OIL GUSHER.

BY CHARLES CARROLL WRIGHT

The largest oil gusher in the history of California, and perhaps the most profitable in the world's history, is the Lakeview in the Maricopa oil field, forty miles southeast of Bakersfield, Cal The gusher started to spout on Tuesday morning, March 15th, and, save for a period of eight hours in which it "sanded up" on March 21st, when it burst forth of its own accord like a volcano of oil, the well flowed continuously up to March 31st, averaging a flow of 48,000 barrels of oil of 18 gravity Beaumé each 24 hours, as measured in the run-off from the sump hole through a ditch in which the oil runs to a rapidly built pipe-line Since that date the flow has continued at the rate of from 42,000 to 45,000 gallons, and up to May 3rd it had delivered about 2,000,000 barrels of oil

The marvel of the gusher has been its sustained productivity During the two weeks following March 31st, 1910, more than one-half million barrels of high grade crude petroleum had been collected from the well The stream rises intermittently from 170 to 240 feet above the top of the derrick, which, before the crown or top was carried away by the stream of oil, was 84 feet in height The oil sands were struck at 2 300 feet, at which point a tremendous gas pressure was encountered and the drillers were suddenly amazed at seeing small rocks hurled hundreds of feet in the air through the eight inch casing After the oil sands were struck, the well rapidly "drilled itself" to a greater depth The well promises to keep spouting for many months to come

The well can be heard roaring for more than a mile. Spray from the gusher has been carried a distance of two and a half miles, and hundreds of automobiles have carried sightseers from Bakersfield to witness the unique sight The sage brush for a distance of half a mile around the well is coated with oil, and several jack rabbits killed by the flow were brought by small boys into Maricopa. All efforts to "cap" the gusher have proved unavailing, the force of the oil flow carried away the crown or top of the derrick and fifteen feet of its uppermost structure, and the tremendous flow created a huge lake of oil extending for hundreds of feet on every side of the derrick

From a money viewpoint the gusher is said to be the most valuable in the world's history, far exceeding the famous Texas gusher in the Beaumont field, which caught fire and subsequently ran into salt water, for the owners of the Lakeview had netted by March 31st over $300,000 from the oil, which is now being piped to tidewater from Maricopa in the San Joaquin valley to Port Harford on the Pacific coast, a distance of 150 miles.

To control the oil from the gusher was in itself no slight achievement Shortly after the great stream amazed the drillers, three pumps with a combined capacity of 25,000 barrels daily, were started working at top speed, pumping oil out of the sump-hole, and the oil so recovered was the first oil to enter the huge tanks built by the independent producers of California.

The big well, which is one of the seven gushers "brought in" in the Coalinga and Midway-Maricopa oil fields of California within the past month, is due to the persistency of a single man. A discouraged board of directors, three days before the gusher was struck, decided to quit drilling. The order was given, but the superintendent conveniently forgot it. He drilled 47 feet more against penalty of dismissal, and the bit entered the oil sands.

To date all efforts to cap the well have proved unavailing, and the oil is now rushing heavenward both on the inside and the outside of the steel casing.

It is an interesting fact that lately the gravity of the oil has risen from 18° Beaumé to 20°. This has been taken to indicate that the oil is now being drawn from a lower strata or "pool."

Correspondence.

WEIGHT DISPOSITION IN AEROPLANES.

To the Editor of the SCIENTIFIC AMERICAN

In your issue of April 30th Mr Godfrey assumes that the center of suspension and center of thrust are coincide , center of gravity low, and center of resistance to the lateral motion in vertical rudder high

In an aeroplane with perfect stability the center of gravity should be low, the center of thrust below the supporting plane yet in the center of resistance to forward motion and the vertical rudder below the center of suspension yet at the center of resistance to lateral motion In my monoplane the operator by shifting his weight slightly can raise the inner wing in making the turn MOSES FRANKLIN

Grand Junction, Colo.

WEED-CUTTING BOATS.

To the Editor of the SCIENTIFIC AMERICAN

I have been a constant reader of the SCIENTIFIC AMERICAN for, I think more than thirty years—back as far I can remember, anyway In the issue which I received Saturday, I noticed an illustration of a weed-cutting boat and a description sent by your Paris correspondent While I do not know that there is a specific statement in the article that it is a new scheme certainly one can only gain that inference from the reading

While I do not remember to have seen a weed-cutting boat exactly similar to that one, they have been in use in this country by many of the ice companies for many years. The Consumers' Company of this city, of which I was vice-president and general manager for a good many years, something like ten years ago built a boat at their own works for this purpose and while owing to the fact that gasoline engines were not then so universally used as at present steam power was used for its propulsion and for the operation of the cutting knives, yet its purpose was the same and it accomplished the same end and in my judgment was in some respects better than this French device As I remember it, we merely built a flatboat about ten feet wide and forty feet long We mounted the wheel at the stern, after the manner of Mississippi River steamboats, instead of at the bow as in the French boat and we placed the cutting knives a the bow They were about the same type as those used on mowing machines and were operated by the same engine that propelled the boat We merel used a small upright boiler and a single-cylinder vertical engine for power, transmitting the power to the stern wheel by chains and to the cutting knives by bevel gears and shafting Right at the front end of the boat convenient to the pilot, was a clutch for throwing the cutting knives in and out of gear The knives were raised and lowered by a gear controlled by the same person This boat at times was run by one individual Of course, it was better to have two—one as engineer and the other as pilot. It was arranged to cut to a depth, I think, of four feet

I know of several boats of this same character used by various ice companies and I think in one respect they are very much better than the French boat as the cutting knives are in front, and the pilot knows just what he is doing all the time and of course, he can run the boat very much nearer the shore and cut the weeds out in very much shallower water Then again, the French boat runs over the tops of the rushes, pushing them down possibly so that the weed cutting knives would not cut them at all

Chicago, Ill JOHN BENHAM

Death of Prof. Angstrom.

The well-known Swedish physicist, Dr Knut Angstrom, is dead. To the general public his passing will mean little, because his investigations were not of the character that attracted public attention To the scientist his death means a sad loss for in him physics has been deprived of one of its ablest investigators

Prof Angstrom was the second generation of a family distinguished for its scientific researches. His father, Johan, achieved fame by reason of his splendid study of the solar spectrum His son, Knut was born in 1857. He studied at the University of Upsala, where he afterward taught. He occupied a professorial chair at the time of his death

Angstrom's first researches were made in the field of spectroscopy By means of the spectrobolometer he studied the phenomena of absorption in the infra red spectrum, notably for carbon monoxide, carbon dioxide, water vapor and ozone These investigations gave rise to an interesting controversy with Arrhenius. Water vapor, carbon dioxide and ozone have a marked influence on the temperature of our globe In effect, they partially hamper the radiation of the earth into inter-stellar space and thus aid in maintaining the surface of our planet at a temperature compatible with the conditions of life With these facts as a basis, Arrhenius built up an ingenious theory to account for the glacial period He supposed that the quantity of carbon dioxide contained in our atmosphere has increased since that period Angstrom proved that Arrhenius' reasoning was valid only for carbon dioxide of almost infinite tenuity and that the possible variations of the tenuity of carbon dioxide in the air could not possibly have had any influence on the temperature of the earth

Angstrom's name will be forever linked with the study of solar radiation An instrument which he invented for the purpose of measuring this radiation and known as the Angstrom pyrheliometer is now widely used in observatories

The Current Supplement.

The government dam across the Salt River at Roosevelt, Arizona is nearing completion after about six years of active work The dam is excellently described and illustrated in the opening article of the current SUPPLEMENT No 1794 by Edmund G Kinyon In an article entitled "New Methods of Polar Explorations the forthcoming expeditions of Lieut Wilhelm Filchner and Capt Scott are described in detail as well as other expeditions The current problems of most interest to those engaged in the branches of science associated with marine construction are usually brought into high relief at the annual meeting of the Institution of Naval Architects. In the present year this has been particularly the case A summary of the Institution's proceedings is presented The inauguration of the Oceanographic Museum at Monaco took place on March 28th in the presence of representatives of the governments of France Germany Italy, Spain and Portugal, and a great gathering of men of science of all nations who were invited by the Prince of Monaco The museum is made the subject of an interesting illustrated article Dr E E Barnard of Yerkes Observatory has made a special study of the aurora In the current SUPPLEMENT the results of his observations between 1902 and 1909 are presented On May 18th, at 9 P M eastern standard time Halley's comet will pass directly between the sun and the earth and its tail will sweep over and envelop the earth In this connection it is interesting to note that a miracle book of the sixteenth century mentions the passage of a very large comet between the earth and the sun and a *phenomenon apparently connected* therewith The circumstances of the passage as given in the work are published Perhaps the biggest comet of the nineteenth century was that of Donati which appeared in 1858 At the time Charles Dickens was Editor of Household Words in the pages of which magazine there appeared an interesting article on the appearance of the comet—interesting because of its attempt to present the phenomenon in a popular way and also curious in the light of our more advanced cometary knowledge Visible Molecules Corpuscles, and Ions is the title of an article in which the modern theory of matter is discussed

A Stabilizer for Aeroplanes.

Regnard has designed an automatic device for steadying the flight of an aeroplane in which use is made of the invariability of the axis of rotation of a gyroscope For stabilizing an aeroplane however it is not necessary to have a gyrostat of great mass, acting directly upon the axis of the aeroplane A small gyroscope, weighing only a few pounds suffices to establish electric contacts in the frame which contains it By means of these contacts currents are sent through motors which operate the steering organs of the aeroplane Two motors are required for this purpose but they may be very small and *light* because they act upon the rudders by means of levers Regnard has not yet had an opportunity to apply his invention to a real aeroplane but he has submitted to the French Academy of Sciences a model of an aeroplane about three feet long resting on a box which contains a gyrostatic stabilizer When the system is inclined in any way the steering organ, whose function it is to restore the axis to its original position, is at once automatically set into motion

What One Firm Pays for Patents.

A recent report of the General Electric Company covering the period of the eleven months ending December 31st, 1909 contains some remarkable figures During the fiscal year the company paid for patents and patent litigation the sum of $904 207 which sum is not counted as an asset but is charged over to profit and loss All the company's valuable patents franchises and good wills stand in the balance sheet at a nominal valuation of one dollar

Mr Richard Bless an inventor who did much to improve machinery of various kinds, died recently at Richmond Hill, Long Island, at the ripe age of 9? years He patented the Culver switch and the first scaling ladder used by the New York Fire Department Hydraulic water-pressure systems for sky scrapers and improvements in sewing machines are also to be credited to him

THE MANUFACTURE OF TWINE

BY DAY ALLEN WILLEY

What is generally known as hemp twine, used in such enormous quantities for various purposes, is manufactured from two varieties of fiber known as Manila and Sisal. Needless to say the first named comes from the Philippine Islands forming one of the principal products of this possession of the United States while the Sisal is secured principally from Mexico the State of Yucatan contributing the largest supply. An idea of the extent of Manila hemp manufactured can be gained when it is stated that each year no less than 125,000 tons are shipped from the city of Manila most of it coming to the United States.

The fiber from the Philippines is obtained from a species of the banana family, which attains a height of fifteen or twenty feet. The stems of the separate leaves grow in a close cluster forming what appears to be a solid tree trunk, to the height of ten or twelve feet, where they separate and branch out like the limbs of an ordinary tree.

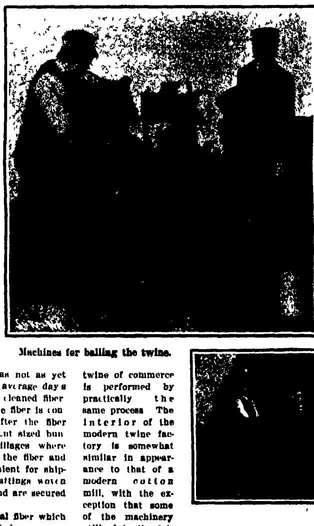
Type of spindles used for converting hemp into twine

The natives cut these stalks off near the ground removing the leaves from the top of the stalk, then separating the stems and removing the pulp from the fiber by repeatedly drawing it across the edge of a dull blade pressed on a block of wood. This primitive method of cleaning the Manila fiber has not as yet given place to modern machinery. The average day's work of a native is eighteen pounds of cleaned fiber.

This work of growing and cleaning the fiber is confined to the mountainous districts. After the fiber has been dried it is packed in convenient sized bundles and brought down to the coast villages where it is purchased by exporters, who sort the fiber and press it by machinery into bales convenient for shipping. These bales are protected by mattings woven or plaited from rushes by the natives, and are secured by rattan bands.

The Henequen plant furnishes the Sisal fiber which is brought to this country. The plant bears a remarkable resemblance to the well known century plant and is frequently mistaken for the latter on account of its appearance. As it forms one of the principal products of Yucatan the Sisal plant is cultivated on large plantations, principally by Indian labor. The young plants on these plantations are set out in rows about ten feet apart. About the fifth or sixth year the plant is sufficiently matured, so that the under and larger leaves are cut, and the pulp removed by decortication, leaving the fibers to dry in the sun, they are then baled ready for market. The plant continues to grow and produces about a dozen mature leaves each year. At the end of a period ranging from fifteen to twenty years the plant dies, and is replaced by a young one.

The method of gathering the Sisal and shipping it to market is much more systematic than the process employed in the Philippines, for nearly all of the Sisal plantations have tramways extending through the Henequen fields, so that as fast as this curious harvest is gathered it can be loaded directly on cars and drawn by mules to the factory, where it is converted into fiber. This is done by the usual method of decortication. The material is fed into the receiving hoppers of the mill by means of an endless conveyer, the leaves being laid upon the surface of the conveyer side by side. By means of toothed wheels they are cut lengthwise into shreds. In this state the material is passed through mechanical cleaners which remove all of the pulp. Next the fiber passes out of the decorticator and is carried to yards adjacent to the mill, where it is hung upon lines and dried by exposure to the heat of the sun. This process concluded, it is pressed into bales of convenient size, and is then ready for shipment to the United States. As already stated, the preparation of Manila fiber is done almost entirely by hand, and before being exported it is also dried in the sun, the natives using long poles, however, instead of rope or wire as at the Mexican plants.



Machines for balling the twine.

The manufacture of both the Manila and Sisal fiber into the twine of commerce is performed by practically the same process. The interior of the modern twine factory is somewhat similar in appearance to that of a modern cotton mill, with the exception that some of the machinery utilized in the latter is missing. This is due to the fact that less care is required in the preparation of the fiber for spinning, since its appearance usually does not increase the value of the finished product. As is well known, the preparatory machinery in a cotton mill is by far the most elaborate apparatus installed. It includes the opening and scutching machine, by which the material is cleaned from dirt and other foreign particles. As the fiber is not a mass of lint like raw cotton, this mechanism is not required, nor is it necessary to form it into bats preparatory to carding. In the modern twine mill, however, the fiber is passed through mechanism which is somewhat similar to the carding engine and performs the same duties, disentangling the fiber by means of revolving cylinders provided with cards which are suitable for treating such coarse material. When carded the fiber is drawn into a conduit, through which it passes between calender rollers and emerges from the machine in a coarse strand. It is then coiled in large heaps either upon movable racks or the floor. This is the first process in preparing the hemp—for such it has now become—for spinning, but before being conveyed to this apparatus, it goes through what is called the finishing machine. This combines in part the drawing and slubbing frames of the cotton mill, so that when the material emerges from it, the strand has been considerably reduced in size and is slightly twisted, enabling it to be coiled in cans, from which it is fed to the spinning jennies. While the spinning machine is of course designed for treating this fiber especially, it is as automatic in its operation as the modern self-acting mechanism, and no more human labor is required to convert the sliver into finished product than is required in the manufacture of yarn and thread from the ordinary cotton. The twine spinning machine includes drawing rolls for lengthening the sliver, the material as it issues from them being twisted by the action of the spindles mounted upon carriages which adjust themselves to the movement of the drawing rolls.

As fast as the twine is spun it is also wound on a large spool or bobbin the latter being taken to the balling machine as soon as it is filled with the twine. The balling machines are also automatic in their operation, not only winding the ball from the bobbin but discharging the finished ball automatically when it has reached the proper dimensions. These machines are calculated to wind balls weighing five pounds each where the twine is used in connection with binders and other agricultural machinery, the balls being packed into cases holding ten each.

At the McCormick plant, which is illustrated in the accompanying engravings, several grades of hemp twine are produced, one of which includes the mixture of Mexican and Manila fiber, as this is found to be very durable. To show the difference in the weight of the material it may be said that a pound of such twine contains 600 feet. The twine made entirely from Manila is slightly finer and averages 650 feet to the pound, while the Sisal is the coarsest, averaging 500 feet to the pound.

Bales of twine ready for shipment

THE MANUFACTURE OF TWINE.

Educating the Farmers by Rail.

BY H. A. CRAFTS

California sees a way to solve the food problem by educating the farmers.

She believes that the farmer is never too old to learn.

She also believes in teaching the young to be farmers.

Accordingly, the State maintains a college of agriculture, a university farm, polytechnic school, United States experiment stations, etc.

Now she proposes to introduce the study of agriculture into the public schools of the State.

A substantial beginning in this line has already been made in the establishment of the study in the high schools, later on it will find a place in the primary and grammar schools.

Then California has its farmers' club, granges, and farmers' unions scattered all over the State, and these organizations exercise a large influence upon the educational thought of the day.

Every year some hundred or so farm institutes are held in various parts of the State and reach annually between 20,000 and 25,000 farmers.

California has the best organized horticultural soci-

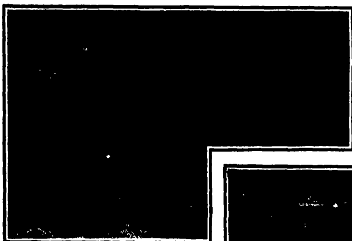
mission in the world, comprising a central office and State insectary at Sacramento and a quarantine department in San Francisco.

Each county covering a horticultural section also has its own local commission, inspectors, etc., while the fruit growers hold two State conventions annually.

These all wield a strong educational influence and add largely to the sum of farm knowledge in the State.

But the latest and most striking feature of California's campaign of farm propaganda is the so-called "Agricultural and Horticultural Demonstration Train."

This train is the joint work of the California College of Agriculture and the Southern Pacific Company, the one supplying the exhibits and corps of lecturers and demonstrators, and the other a fully equipped railroad train comprising three exhibit cars, a lecture car, a sleeping car and diner, all absolutely free of cost to the State.



Separating the coarse from the fine fiber.

The work of the train is arranged in a series of annual tours, covering all the leading agricultural and horticultural sections of the State.

Each series consists of five separate tours, each tour covering from 500 to 1,000 miles, and from twenty to twenty five stopping places. The work of the train begins in the late fall and ends in the late spring. It does not specialize like the demonstration train of the East but covers all the leading lines of agriculture and horticulture.

Its corps of lecturers contains some of the ablest members of the faculty of the College of Agriculture, and the president of the university, Benjamin Ide Wheeler, frequently joins the train in its course, and lends his aid to the work of general farm enlightenment.

The Southern Pacific Company very candidly admits its own interested motives in the premises, and frankly explains that it discovered a serious falling off in its local tonnage, and when the matter was investigated it was discovered that the shrinkage was found in the item of farm produce.

They consulted their local freight agents as to the underlying causes, and were told that the principal cause was an exhaustion of the soil.

This was hardly believable, and the company consulted the soil experts of the College of Agriculture who denied the theory of exhaustion, but explained that the soil had been depleted by a practice of poor cultural methods.

This led to the organization of the "Agricultural and Horticultural Demonstration Train."

And it only needs a glance at California's industrial statistics to convince one of the truth of this charge of wasteful husbandry.

California thirty years ago was one of the leading wheat-producing States of the Union. In the year 1879 its wheat output amounted to not less than 1,707,500 tons, in 1904 the annual product of wheat had dwindled to 465,028 tons, a shrinkage of more than seventy five per cent.

California was formerly a great exporter of wheat and flour. In the year 1882 she exported not less than 1,128,031 tons of wheat and 919,898 barrels of flour.

In 1904 her exports of wheat had dwindled to 54,381 tons and flour exports to 882,486 barrels. To-day both the export of wheat and flour are nil and the State is compelled to import a million dollars' worth of wheat annually in order to keep her mills running, and her flour up to standard grade.

And all a result of poor farming, as is evidenced by the fall of the average annual yield per acre of wheat from forty to less than fifteen bushels.

Combing out the hemp preparatory to shipment.

It is this era of wasteful farming that California desires to put a stop to, and hence inaugurates her campaign of agricultural education.

The "Agricultural and Horticultural Demonstration Train" is developing unlooked-for efficacy. It was originally intended for the enlightenment of the present generation of farmers, but its influence is being carried beyond that limit, it is being brought to bear upon the rising generations, and the young folks are fully as much in evidence at the lectures and demonstrations as the older ones.

At each stopping place for lectures the local schools of all grades are dismissed and the pupils allowed to attend, a privilege that is evidently appreciated by all.

They crowd the demonstration cars and lecture car, attend open-air lectures, lectures and discussions in neighboring school rooms, public halls, and opera houses, and are found in attendance whether the gathering be in the daytime or in the evening.

The subjects dealt with by the agricultural and horticultural lecturers cover a wide field, including plant culture, plant diseases, and plant pests, viticulture, animal industry, dairying, seeding and soil treatment, etc.

Special stress, however is laid upon the vital importance of restoring the lost fertility of depleted soils and the maintenance in their composition of that vital element known to agricultural sciences as humus, all of which has a direct bearing upon the increase in the production of food-stuffs sufficient to supply the demands of a constantly increasing population.

Fire Control in the National Forests.

Probably one of the best things in the line of an agreement has just been signed by the Secretary of Agriculture and several railroads whose lines run alongside of the national forests. Two of the largest and longest roads in the Northwest (the Great Northern and the Northern Pacific) have right of way through some of the richest timber districts in the West and this agreement is of great benefit.

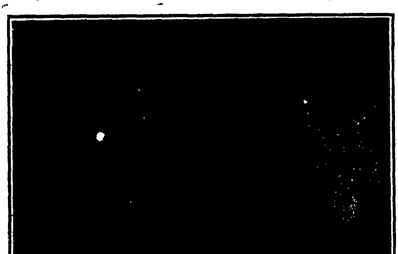
They have in view both the reduction to the lowest point of fire risk from the operation of the railroads and joint action by the Forest Service and the railroads to fight all fires which may start along the lines. Both companies have agreed to clear and keep clear of inflammable material a strip of varying width, as conditions demand, up to 200 feet beyond the right of way, and to provide all locomotives which do not burn oil, with suitable spark arresters and other standard equipment to prevent the dropping of fire. An effort will also be made by the companies to so operate their engines as not to cause fires.

In fighting fires the railroads and the Forest Service will co-operate closely. Notification will be made promptly to the Forest officers of all fires discovered by employees of the railroads. Telephone wires to make this possible will be put up by the Forest Service using the companies' poles where this is possible. Warning whistles will also be sounded by locomotives on occasion.

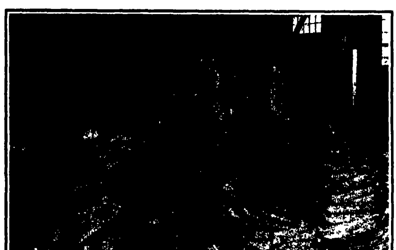
Winding the material into canisters for spinning.

Forces of fire fighters will be assembled on the outbreak of fires, and will be made up of Forest officers, railroad employees, and such temporary labor as can be gathered by either. The cost of fighting fires which start within 200 feet of the railroads will be borne by the companies and of all others by the Forest Service, unless it is shown in the first case that the railroads were not responsible or in the second case that they were responsible for the outbreak of the fire. It is the intention of the Forest Service to patrol the rights

(Concluded on page 427.)



Manila hemp; the raw material as it comes from the ship.



Preparing the hemp for spinning.

DAMMING THE MISSISSIPPI

BY W. P. GREEN

Excelled only by the monster dam across the historic Nile River, the greatest engineering feat in the history of the Middle West is under way on the Mississippi at Keokuk Iowa the point from which Col Roosevelt started his river journey to the far West several years ago A huge dam is being built across the Mississippi at the foot of the rapids which lie to the north of Keokuk, and the stored energy of the river is to be used in generating over 200 000 electrical horse-power The power will be distributed throughout the Middle West, the first long distance transmission line running to St Louis 170 miles south of Keokuk where forty per cent of the power to be developed is now under contract The bed of the river at this point affords an excellent rock foundation The dam will be built of reinforced concrete, and over 500,000 barrels of cement, and 7,000 tons of steel will be required in the construction of this gigantic work

The dam, including abutments, will be 4 700 feet long, or seven-eighths of a mile The spillway section will be 4,400 feet in length The dam will rise 37 feet above the river bed, and the base has a width of 43 feet. On top of the spillway will be placed 116 steel flood gates, 30 feet wide and 11 feet high, supported by concrete piers. The piers are to be built integral with the dam, being carried down to bed-rock on the upstream side They will support an arched bridge, from which the gates will be operated by electric hoists. Through the manipulation of these gates the water above the dam will be maintained at a constant level at all seasons

Four fifths of the dam, the 4,400-foot section, will extend in a straight line across the river, breasting the current of the broad river The balance of the dam will be built approximately parallel to the shores and at right angles to the main dam This portion, 1 100 feet long 123 feet wide and 133 feet high, will be occupied by the power house The substructure, built of massive concrete, will contain the water passages and waterwheel chambers Upon this will be the superstructure containing the electric generators, transformers and switchboards There will be thirty power generating units each consisting of a vertical steel shaft, carrying on the lower part two turbines, or water wheels On the upper part, on the floor of the power house, will be the revolving parts of the generators.

To keep floating ice and logs from entering the power house, an ice fender will be built upstream from the upper end of the power house, curving in toward the shore This will be 2,800 feet long and built of concrete masonry.

The construction of the dam will entirely destroy the government canal, built to carry shipping around the rapids. This canal now consists of three locks. In its place a single large lock will be built. There will thus be substituted for the canal a lake of deep water over a mile wide at the dam, and 40 miles long. The government has given permission to build the dam. Landowners on both sides of the river will be given a fair price for all land overflowed as the result of the creation of the reservoir

The construction of this gigantic river project is under the direction of Hugh L. Cooper of New York city The work of excavation is well under way on the Illinois side of the river, the project will be pushed as fast as the material is delivered at the site

This huge structure, over a mile in length is being built across the Mississippi at Keokuk, Iowa. The dam, which is broadly similar to the Assouan dam across the River Nile, is provided with 110 flood gates to control the height of the floods. A lake 40 miles long will be formed and ultimately 200,000 electric horse-power will be generated in the power house shown at the left of the dam.

THE HUGE DAM WHICH IS BEING BUILT ACROSS THE MISSISSIPPI

The Oceanographic Museum of Monaco.

The Oceanographic Museum of Monaco was formally opened on March 29th, 1910, by its founder, Prince Albert I of Monaco, in the presence of representatives of various foreign governments. The celebration included a pyrotechnic exhibition and an allegorical pageant in the beautiful bay of Monaco, a gala performance at the opera and other festivities. The new museum, which is also a laboratory, is connected with the Oceanographic Institute of Paris and both institutions, with an endowment of four million francs ($800 000) have been presented by Prince Albert to the French government in recognition of the hospitality which Paris and France accord to all workers in the field of thought Prince Albert is president of the administrative council of the Institute, which includes among its members ex President Loubet and the physicists Cailletet and Becquerel The direction of the scientific work is confided to an international committee for it was Prince Albert's design to found an institute and a laboratory in which investigators of all nationalities could work together for the advancement of the new science of oceanography The lecture courses of the Institute were inaugurated in 1903, at the Conservatoire des Arts et Métiers. The lectures have since been given in the old building of the Academy of Medicine and at the Sorbonne. The new building of the Oceanographic Institute will soon be completed, and the lectures will be given there after October next

The Oceanographic Museum of Monaco, which has already received the popular name of the Palace of the Sea, is built on the flank of a steep cliff at the edge of the sea. On the water side the building is 256 feet high, while the height of the main façade on the land side, is 148 feet, the difference being due to the slope of the cliff The length of the building, parallel to the water front, is 330 feet The cost of construction exceeded $1,500,000 There are only four stories, and the rooms are very high, large, and well lighted The two lower stories which are partly underground, contain the aquariums and laboratories, while the upper stories are devoted to the exhibition of sounding and other apparatus, and of the rich and varied collections of deep-sea fauna and flora which represent the result of a quarter century of exploration Prince Albert has also placed a small steamer, the "Eider," at the disposal of the Museum

Almost every year since 1885, the Prince of Monaco has made a scientific cruise in the Mediterranean, Atlantic or Arctic Ocean The experience acquired with the "Hirondelle," a sailing yacht of 200 tons, and afterward with the "Princesse Alice I," an auxiliary three-masted schooner, 170 feet in length, was put to good use in the construction and equipment of the "Princesse Alice II," with which the later cruises have been conducted This vessel has a steel hull, a length of 240 feet, a breadth of 34 feet, a displacement of 1 400 tons, and a maximum speed of 13 knots. It contains the most improved apparatus for taking soundings and temperatures and collecting specimens of fauna, flora, sand, mud etc, at very great depths. A great part of this apparatus was invented and constructed by the Prince and his assistants.

The cases of the Museum contain representatives of all known deep-sea fauna. Many of these specimens are interesting even to the non-scientific observer because of their strange forms, beautiful colors, and peculiar organs of sight and touch.

These oceanographic explorations and collections also possess great practical value, in addition to their scientific interest. Most edible fishes feed upon the plankton or mass of small animal organisms which are wafted hither and thither by even feeble ocean currents.

The explorations have proved that the plankton moves in a manner dependent on the season and the locality These migrations appear to be governed by complex laws, the knowledge of which, as it is gradually developed, will be of great value to the fisheries, especially to the steam fisheries, as the fish follow the plankton

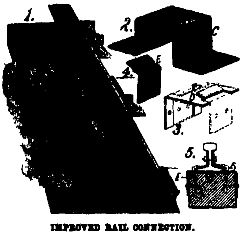
In commemoration of the inauguration of the Oceanographic Museum, the Prince of Monaco has caused a plaque to be struck in gold, silver and bronze. The six gold plaques were presented to the president of the French Republic, and the sovereigns of Germany, Italy, Spain, Portugal and Monaco. One hundred plaques in silver and twenty in bronze were distributed among the other invited guests.—L'Illustration

The Electrical World remarks that in a report submitted by the chief signal officer of the United States army to the Secretary of War, it is stated that there are now in the army service a total of 3[illegible] wireless telegraph stations, of which 13 are in the United States, 9 in Alaska, 5 in the Philippine Islands, 5 on artillery harbor tugs, and 7 in the [illegible] transport service The signal corps has purchased a [illegible] 100,000-cycle alternator for wireless [illegible] service The advisability of the United States adhering to the International Radiotelegraphic Convention, [illegible] is recommended for the consideration of the United States Senate. Wireless telephone [illegible] are now being erected at the Bureau of [illegible] and at the quarters of the signal corps of the army, in Pennsylvania Ave., Washington, to make experiments with the object of selecting the [illegible]

Patent Department

IMPROVED RAIL CONNECTION.

To prevent the destructive hammering of the rails when depressed by the passage of a train, a new construction has recently been designed to furnish a more substantial support at the rail joints for them It

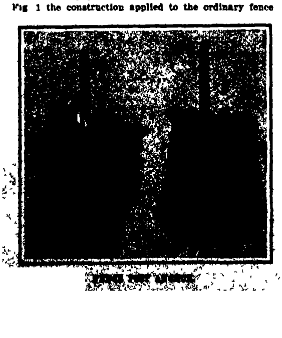


IMPROVED RAIL CONNECTION.

consists in providing timbers or ties running longitudinally under the rails at the joints In addition to this, a number of very substantial metallic fastenings serve to clamp the rails tightly in position It is usually the case that the joints of a railroad are arranged to come between and not on the ties and heavy fishplates are depended upon to support them The construction here illustrated is intended to offer an improvement on such an arrangement of the joints As shown in the accompanying engraving, the two ties A, between which the joint comes, are depressed, and on them is laid the longitudinal timber B The latter is clamped down to the ties by means of a metal fastening C, which is shown in full in Fig 2 This is substantially of U form, and may be termed a "saddle piece" It is preferably mortised into the timber to the depth of its thickness. The base flanges are secured to the ties by means of spikes Each saddle piece is cut out at the top to form a hook or lip that engages the outer side of the rail base and thus prevents outward movement or spreading of the rails. At the joint the rails are connected by the usual fishplates and bolts and are secured firmly to the timber B by means of a metallic fastening D such as shown in Fig 3 and a pair of fastenings E, such as shown in Fig 4 Fig 5 is a cross-sectional view of the rail joint, and shows how these fastenings are applied The fastening D is approximately L-shaped, and passes under the base of the rails, being formed with a hooked portion, which engages the inner side of the rail base Over this hook, one of the fastenings E is applied, while at the opposite side is another fastening E, the fastening D being cut away to receive it Thus a very strong joint is provided, which should reduce the unpleasant hammering noise at the joints and also increase the safety of the railroad The inventor is Mr Henry Grass of Alvin Texas.

FENCE POST ANCHOR

A patent has recently been granted on a novel method of supporting a fence post, so that it will with stand excessive strain. The construction will be especially useful for anchoring corner posts. The device is very simple and inexpensive and may be readily attached to any post In our illustration, we show in Fig 1 the construction applied to the ordinary fence

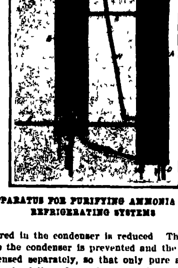


FENCE POST ANCHOR.

post, while in Fig. 2 is shown the construction used for corner posts. In both illustrations the post is designated by the letter A At the bottom of the post is an anchor plate B, which at one end is flattened out to form a blade C The opposite end of the anchor plate is doubled upon itself to receive the lower end of a diagonal brace D, the upper end of which is bolted to the post. An angle brace E is secured to the opposite side of the post and connects it to the anchor plate B The spikes which pass through the anchor plate are long enough to be driven to a considerable depth in the ground, and serve as additional means for preventing the anchor plate from sliding out of position In use a trench is dug at the point where the post is to be erected The trench is just wide enough to receive the anchor plate B, and the blade C of the plate is driven into the undisturbed ground at the end of the trench, thus affording a firm anchorage. Thereafter the post is erected on the anchor plate and the braces D and E are bolted fast For corner posts, the anchoring device is used in duplicate The blades C of the anchor plate are driven into the ground at the side, where there will be a lifting strain imposed by the tension of the fence wires. The inventor of this anchoring device for fence posts is Mr Julius Laux, of Flatonia, Texas.

AMMONIA PURIFIER FOR REFRIGERATING PLANTS.

A recent patent discloses an improved method of purifying ammonia, so as to render it anhydrous in refrigerating plants The object is to produce a high grade of anhydrous ammonia continuously while the compressor is in operation An apparatus is provided which is connected in circuit with the compressor and condenser and removes a portion of the heat from the compressed ammonia so as to condense the oil and water vapor and permit dry or partially cooled but uncondensed ammonia to be delivered to the condensing coil In this way the amount of cooling that

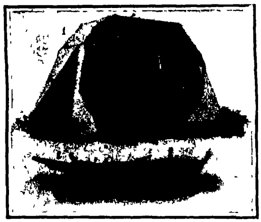


APPARATUS FOR PURIFYING AMMONIA FOR REFRIGERATING SYSTEMS

is required in the condenser is reduced The passage of oil to the condenser is prevented and the ammonia is condensed separately, so that only pure anhydrous ammonia is delivered to the expansion valve The apparatus comprises two holders or drums A and B which are connected at the bottom by a pipe C The drum B is preferably raised above the drum A The compressed ammonia enters the drum A, through a pipe D then passes through one or more connecting pipes E to the drum B after which it passes out through the pipe F The cooling system consists in a pair of water chambers G and a pipe H, connecting the top of the water chamber in drum B with the bottom of the chamber in the drum A The water passes through the cooling system in the reverse direction to the flow of ammonia through the apparatus The temperature and rate of flow are so controlled that there will be no condensation of ammonia in the gas holders, but all the oil and water vapor which may be carried along with the ammonia will be condensed in these holders and accumulate in the lower portions If the valve in the pipe C is opened, the oil and water will flow into the bottom of the drum A and may be drawn off at that point The object of letting the pipe from the compressor pass up through the oil and water in the drum A is to heat the oil and thus prevent as far as possible the loss of ammonia The inventor of this apparatus is Mr Lawrence Wagner of Missouri Avenue and Missouri Pacific Tracks, Sedalia, Missouri.

CONVERTIBLE BOAT AND TENT.

For the benefit of campers, hunters, and the like, a folding tent has recently been devised which may be packed into a very small compass and which may also be converted into a canvas boat. Our illustration shows the device in its two forms, partly broken away to reveal the framework It will be observed that the upper portion of the tent comprises a pair of lazy tongs A, connected by cross bars B These are supported on four posts indicated at C and D, and the structure is rendered quite rigid by means of a system of guy wires. Swung from the framework are a pair of bars E which support a hammock F The upper portion of the tent frame is covered with water proof canvas, and in addition to this, there is a lower canvas section which may be fastened to the upper section by means of buttons, thus forming a spacious tent, and the occupant can sleep on the hammock,



CONVERTIBLE BOAT AND TENT

which is a decided improvement over using the ground for a bed When breaking camp the posts C and D are withdrawn from their sockets and the lazy tongs are folded up, so that the entire framework of the tent may be placed in a small bag To convert this framework into a boat it is extended and inverted, so that the cross bars B form the bottom of the boat The bars E of the hammock are hooked to the framework at one end and fastened together at their outer ends to form a bowsprit for the boat. The bowsprit is braced by a pair of arms H which are hinged to the cross bar G It will be observed that the lazy tongs at J are extended to form oarlocks and the posts C of the tent are so constructed as to form oars The seat of the boat is supported on a pair of longitudinal beams K The canvas top of the tent is applied to the framework inclosing it and thus forming a flat bottomed canvas boat of large capacity Mr Joseph Vaghi of Bethel, Conn has just secured a patent on this convertible boat and tent.

INDEX SYSTEM FOR POCKET MEMORANDA

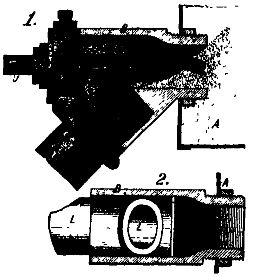
A patent has recently been granted on an improved pocket memorandum book, which is provided with a novel indexing system The first leaf of the book is shorter than the others and serves as a topic list, being ruled to allow of entering various topics on which notes are to be kept The other leaves of the book are cut with series of tabs as shown in the illustration the tabs on each leaf corresponding in number to the topics provided for in the topic list. When notes on a subject are entered on one of the leaves of the book, all the tabs of this leaf except that opposite the topic to which the notes relate are cut away When a leaf is filled, it may be removed and filed away in a card index If it is desired to permit the leaf to remain in the memorandum book after it has been completely filled the tab is partially cut away so that it will still serve to locate the leaf but will not interfere with the thumb in readily finding the next tab underneath in the same series In this way the entire memorandum book is so arranged that the matter it contains is always properly indexed, and may readily be referred to whenever desired Furthermore the material is so placed and the leaves are so arranged that when they are removed and filed

MEMORANDUM BOOK WITH NOVEL INDEX SYSTEM

in a card index no transcribing of the notes is necessary. The device should be of particular advantage to the modern farmer, horticulturist, gardener, or stock man, who must have some convenient way of collating and preserving the data of his daily work if he is to get a full measure of profit and satisfaction out of his experience from year to year. He cannot afford to trust his memory with much important detail, and an elaborate system of keeping a record does not appeal to him. The pocket memorandum book with topical index should meet his needs. The inventor of this memorandum book is Mr. E. A. Bagby, 1107 Brook Street, Louisville, Ky.

IMPROVED TRACK SANDER.

Pictured in the accompanying engraving is an improved track sander for use with locomotives. The apparatus is so arranged that two jets of compressed air are employed, one of which is directed against the sand in the sand box, serving to agitate it, while the other acts to discharge the same continuously and smoothly. Special precautions are taken to prevent the nozzles from being clogged with sand. In our illustration the sand box is indicated at *A*. The sander casing *B* is substantially of Y form. It is threaded into the sand box and held in place with a lock nut. At the opposite end of the casing is a plug *C*, provided with an extension *D* constituting the nozzle. At the extreme inner end of the extension *D* the bore is constricted to form a jet opening, which communicates with a recess in which a ball *F* is placed. In addition to this, there is an inclined jet opening *E*. At the opposite end of the plug there is a screen *H* which serves to strain the compressed air that enters by way of pipe *J*. In the other leg of the



IMPROVED TRACK SANDER.

Y-shaped casing is the pipe *L*, which leads to the point at which it is desired to discharge the sand. Within the casing, and extending partially over the passage leading to pipe *L* is a shelf *K*. In operation, when compressed air is admitted to the nozzle it forces its way past the ball *F* into the sand of the sand box *A*. A portion of the air is directed backward to the jet opening *E*, producing a partial vacuum, which causes the sand that is agitated by the other jet of air to flow along the shelf *K* and thence be carried down the discharge pipe *L*. The ball *F* prevents the constricted opening in the nozzle from being clogged with sand, and this constricted opening serves to reduce the fluid pressure by permitting its expansion past the ball *F*, so that a destructive sand blast is avoided thereby. The inventor of this improved track sander is Mr. John Henry Watters of Augusta, Ga.

BRIEF NOTES ABOUT NEW INVENTIONS.

The singing sign which has been recently placed in front of a Denver business house is a visual as well as audible means of attracting the attention of passers-by. The particular sign referred to displays the word "Dentists" and is of the electric flashing type. The illumination of one letter follows the other, and as the lamps comprising each letter are flashed, a wooden hammer strikes one of a group of orchestral chimes. There is a different bell for each letter, and the chimes represent a complete octave. The combination of sounds may be varied at will with but little trouble.

The illuminated elevator threshold is a new means to prevent what is a quite common form of elevator accident. The elevator attendant, making hundreds of stops in the course of a day, is not always enabled to bring the car to a halt at the exact floor level, and a very slight variation is sufficient to give the passenger a jolt if not more serious injury. The floor of the car being held an inch or two above that of the building is likely to trip the unguarded person about to enter the car, while persons stepping out are liable to be thrown down. The latest method of avoiding this is the insertion of a pair of plate glass lenses in the metal of the threshold, with an incandescent lamp under each. These are kept in operation all the time the car is in use. The lamps are supplied through the elevator cable in the same manner as the overhead lamps. This device has been tried with eminent success in some moving-picture establishments, where the rear seats are slightly above the level of the aisle floor.

The jobbing carpenter moving around from one place to another, and locating for a few days at a time in one spot, in the course of his peripatetic career is compelled to spend considerable of his time in the construction of wooden horses or trestles, which are generally so necessary for his work. These things are of such an awkward shape and size that it is out of the question to carry them from point to point, so he is compelled to build them in many cases before he can proceed with his work. To meet such demands, horses of steel with collapsible legs have recently been made, so that they may be readily packed up and carried from place to place. The legs fold over on the back of the trestle when not in use and when being transported, and in this form they are very compact. Being of angle iron, the trestle is not heavy and is almost everlasting.

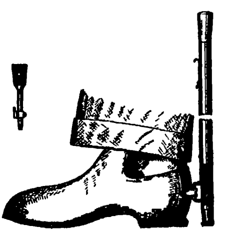
ODDITIES IN INVENTIONS.

Hat Fastener.—The recent agitation against long hatpins has set a Yankee inventor to thinking. He has arranged a hatpin which has no exposed point and which does not have to be removed from the hat, but which may be operated to engage the hair by giving it a half turn. The hatpin extends from side to side of the crown of the hat, and is provided

A NOVEL TYPE OF HATPIN.

with a series of hooks or grapples sharply pointed at the ends, so that when the pin is turned they will hook into the hair. Whether the hat fastener has been tried in actual practice we do not know, but it seems as if there would be considerable danger of entangling the hair in the curved hooks.

Device for Drawing on and Removing Overshoes.—An inventor does not have to go far afield for objects upon which to exercise his inventive faculties. Even in the most commonplace matters of everyday life there is room for improvement. Take, for instance, the method of removing one's overshoes: the usual way of teetering on one foot while trying to kick the shoe off the other foot is most awkward, to say



DEVICE FOR DRAWING ON AND REMOVING OVERSHOES.

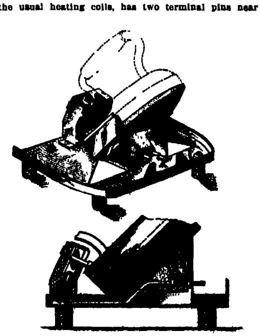
the least. Recently, an inventor has devised a little attachment for the cane or umbrella, whereby one can stand firmly on one foot and steady himself with the umbrella while removing the overshoe by pressing the lug at the back of the overshoe against the attachment on the umbrella. The inventor has provided a more elaborate device to hold the overshoe in place while drawing it on. The lug at the heel of the overshoe is so formed that it can be engaged between a pair of jaw clamps, one of which is fixed while the other is spring-actuated. The device is applicable to a cane, and running from the movable jaw to within a convenient distance of the head of the cane is a rod, which may be lifted to release the jaws.

Luminous Gun Sights.—When using a gun in the dark or deep twilight, it is very difficult to secure accurate aim, because the sights are invisible. This difficulty has frequently been experienced by sentries,

LUMINOUS SIGHTS FOR TWILIGHT SHOOTING.

who should be able to cover an approaching enemy with accuracy, in order to secure their own safety as well as that of the camp. To enable this to be done, an inventor has recently devised a gun in which the sights are luminous. This is effected by means of a pair of small electric lamps lighted by batteries placed in the stock of the gun. The sectional views in the accompanying cut show how the lamps are arranged. The sights are formed with prisms, which at their lower ends communicate with chambers in which the lamps are located. The lamps are lit only when the trigger is partially pressed, so that it is not necessary for the sentry to expose his whereabouts until he is ready to fire. The sights are of such a nature that they may be used in the daytime with the lamps disconnected, a switch being provided for opening or closing the lamp circuit.

Support for Electrically Heated Flatirons.—A novel support has recently been invented for electrically heated flatirons. It is so arranged that the current is turned on only when the iron is on the support. The support consists of a metallic base provided with legs of insulating material and upon which is mounted, in inclined position, a plate of slate. On this the flatiron is adapted to be supported, so that the head of the flatiron will slide down and bear against a block of insulating material at the rear of the base. In this block are two sockets, provided with metallic clips forming the terminals of an electric current. The flatiron, which is provided with the usual heating coils, has two terminal pins near



SUPPORT FOR ELECTRICALLY HEATED FLATIRONS.

the heel. These are adapted to engage the clips when the iron is in position on the slate. This completes the circuit through the coils, and serves to heat the iron. As soon as the iron is removed from the stove, the circuit is broken, and there is no waste of current or dangerous overheating liable to cause a fire.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

TELAUTOGRAPH INSTRUMENT.—A. L. GOLDEN, Oakland, Cal. This instrument is for use in copying written matter or drawing by electro-magnetic means. An object of the invention is to provide a device by means of which a person at one station may write a letter, sign his name or execute a drawing, which a similar device will reproduce at another station in the form of an exact duplicate.

Of Interest to Farmers.

SIX-HORSE DRAFT MECHANISM.—H. MASSMAN, Kentland, Ind. This invention has reference to draft mechanism or draft gear enabling a number of horses or similar draft animals to be attached to a plow or other implement, and provides a construction which will equalize the leverage and pulling force exerted by the different animals.

GRAIN SPREADER AND FEEDER.—A. CLARK, Portland, Ore. The improvement relates to a device applicable to the feed or supply table of threshing machines and machines of a like type, being especially designed for use in connection with the feeding of headed grain, which, even under the most favorable conditions of service, frequently "slug" the cylinder.

CHURN.—W. F. S. SMITHDEAL, Salisbury, N. C. In general the invention may be defined as consisting of a pyramidal frame having bead blocks spaced apart, the blocks having slots in vertical alinement entering the edges from one side of the frame, a hand lever fulcrumed at the opposite side of the frame and having a cross arm, a dasher shaft, removably journaled in the slots and having a belt wheel and a belt detachably connected to the arm and passing around the wheel.

Of General Interest.

COMPOSITE BEAM STRUCTURE.—W. P. FRANCIS, Pensacola, Fla. Among the principal objects here is to provide a construction wherein is combined the tensile strength of metal formation with the immobility of masonry, to provide a composite structure of metal and masonry whereby the metal members are arranged in truss form, to provide a fireproof construction for a carrying beam.

LINE-CLINOMETER.—E. H. HOLDEN, New York, N. Y. This improvement comprehends a line clinometer provided with a telescope and a level associated therewith, the telescope being adapted to turn in a substantially vertical plane, and means including a vernier and a level for measuring the extent of inclination of the telescope from a given real or imaginary line.

ELECTRIC FURNACE.—H. W. HIXON, Philadelphia, Pa. More particularly this invention relates to those furnaces used in the smelting of zinc ores. An object is to provide a furnace in which the zinc is fed in at the top, which is kept closed by means of a top of double construction so arranged that an upper door may be opened and a charge fed in while the lower door is shut.

Hardware and Tools.

PADLOCK.—A. M. H. DE BRUYCKER, New York, N. Y. This invention relates to locks having a main bolt formed of hook members, such, for instance, as shown and described in the Letters Patent of the U. S., formerly granted to Mr. De Bruycker. The aim is to provide a padlock having both sides of the hasp notched for engagement by the hooked members of a bolt actuated by key controlled means.

NAIL-HOLDER FOR HAMMERS.—H. SCHNEIDER, New York, N. Y. The holder is arranged to hold the nail and to start it prior to driving the nail home, and to readily accommodate nails of different length. For this purpose the head of the hammer is provided with integral abutments located different distances from the face of the hammer head and retaining means in alinement with the abutments for temporarily holding a nail, the head of the nail abutting against the corresponding abutment.

Heating and Lighting.

SHOCK ABSORBER FOR TUNGSTEN LAMPS.—F. SCHWARTZ and L. KLEINMANN, New York, N. Y. This invention is particularly useful in connection with electric lamps such as tungsten lamps having fragile filaments. The purpose is to provide a hanger having a shock-absorbing device for supporting the lamp, which will operate to prevent the transmission of a jar or shock to the lamp, which might be otherwise transmitted from the ceiling or wall.

CANDELABRUM.—C. YOOS, New York, N. Y. This candelabrum is such as used in churches, chapels and similar places where candles are left burning continuously. A special construction operates to bring about a complete consumption of the candle. The invention resides partly in the nature and form of the bobache or cup which supports the candle. The construction is such as to prevent the accumulation of wax or candle grease upon the parts.

Household Utilities.

TRAP.—M. L. FRANCIS, Onida, S. D. In this instance the invention relates to traps for use in catching insects, and resides more particularly in a trap for flies and the like, comprising apertured screens adapted to entrap the insects, and so constructed as to permit of the same being removably used on screen doors, window screens and like protections.

WASHBOARD.—D. STEIN, New York, N. Y. This improvement relates to metal washboards. In this board the inventor forms the entire frame, that is, the side bars and the top or transverse member, all of a single piece of channel iron, and the width of the groove in the channel is such that the corrugated metal rubbing surface is firmly held therein. The board is reversible.

MOP HEAD.—W. H. ZACHRY, Atlanta, Ga. In this device the improved head is simply constructed, is efficient, and all the operative mechanism is concealed by the cover plate. When not in use the parts may be separated, to permit the threads to dry, thus preventing rust, and increasing the longevity of the head. As an article of manufacture, the device could possibly be marketed without the handle.

Machines and Mechanical Devices.

APPARATUS FOR BEADING OR TURNING OVER BOILER TUBES.—H. E. A. GALLON, 22 bis Rue du Cours, Sotteville les Rouen, France. This improved apparatus contrary to those of former invention enables work to be done on plates which are out of shape and in oval holes without any trouble, to obtain different sections of flange on tubes which may be of different diameters and of producing on the work rolling forces which are capable of insuring perfect connection of surfaces which are to maintain damaged tube plates fluid tight.

CUE TIPPING MACHINE.—G. MAHONEY, Iowa City, Iowa. This machine is for use in forming and trimming the tip of a cue or the like. The device is easily manipulated and quick and accurate in its operation. It consists of a plurality of cutting, trimming and filing wheels, driven by a suitable means and juxtaposed to suitable work supports or rests.

CLOTH CUTTER.—M. LANGMAN, New York, N. Y.—The purposes here are: To keep the blade constantly sharp by operating upon it for this purpose while it is in action cutting cloth; to throw the sharpening mechanism out of working relation at the will of the operator without moving it from the blade and parts associated therewith. To provide various details of construction for improving the general efficiency of cloth cutters.

COIN DIRECTOR FOR VENDING MACHINES.—W. ASBURY, New York, N. Y. The object of this invention is to provide a coin director disposed in the coin chute of a vending machine, which will alternately direct coins in opposite directions. An object is to provide means which will permit coins of less than predetermined diameter to pass through an opening in the coin chute so that they will not engage the coin director.

Prime Movers and Their Accessories.

STEAM-GENERATOR.—I. WICHROWSKI, 622 Myrtle Avenue, Brooklyn, New York, N. Y. This device has a flat rectangular partitioned compartment disposed directly over the furnace, with communication in the partition, one compartment subdivision for use as a superheater, there being a steam dome in communication with the former and a water supply in communication with the boiler, the boiler being disposed over the flue, which has a continuation which is disposed in the steam dome. A valve is provided in the communication between the superheater and steam dome. The inventor gives information that steam generates rapidly on high pressure and temperature. It is particularly adapted for steam turbines.

STEAM TURBINE.—T. FALVEY, London, England. This invention relates to improvements in turbines of the kind previously invented by Mr. Falvey, wherein the rotor consists of a disk carrying upon one of its faces concentric annular series of tangentially inclined vanes which alternate radially and are adapted to co-act with similar series of vanes reversely inclined, carried upon the opposed face of the stator of the turbine, the steam passing radially outward through the successive series of vanes into a peripheral exhaust channel in communication with the exhaust pipe.

SAFETY-GATE.—E. KRANCHER, New York, N. Y. This invention relates to safety gates, suitable more especially for use upon cars and similar railway vehicles, the more particular purpose being to prevent persons from passing from one car to another while the train is rounding a curve, or at least to warn such persons of this danger.

DEPOSITING BOX AND TIME STAMP.—C. A. NAUCK, Little Rock, Ark. This invention has reference to time recorders, and its object is to provide a new and improved depositing box and time stamp, designed for use in receiving articles such as envelops filled with transfer tickets as used by railways, the device providing the article stamped indicating the time of day or night, and depositing the accumulated articles in a box for convenient removal after a day's work.

COUPLING FOR AIR-BRAKE PIPES.—L. A. PETERSON, Hannaford, N. D. The improvement relates to means for reliably coupling together the sections of an air-brake supply pipe that extend from car to car throughout a train, and particularly to such appliances as are provided for conveying air under pressure to the air-actuated brakes of a train of freight cars.

Railways and Their Accessories.

TRAIN-ORDER HOLDER.—A. W. VICK, Savannah, Ga. This device is of book form, having means to retain the orders stretched out of the inner side of either cover and present the same, when the holder is open, in a visible and accessible position, thus avoiding the handling, folding and careless pocketing of the orders by trainmen and insuring a careful and frequent reading of the orders, the holder being preferably removably supported on a bracket with the latter arranged to cause the covers of the holder to swing apart and remain open when the covers are unlatched.

Pertaining to Recreation.

AMUSEMENT DEVICE.—J. J. TREANOR, New York, N. Y. More specifically the invention relates to an amusement device having movable hurdles or obstacles, and means for actuating the same so that a child can jump or skip over the hurdles as these travel thereby providing a substitute for the ordinary jumping or skipping rope.

Pertaining to Vehicles.

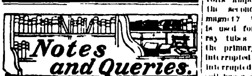
RUNNING GEAR FOR VEHICLES.—D. H. MASTERS, Cliff, New Mex. The details of construction for the running gears more particularly for automobiles adapt said gears to reliably coöperate for swinging the ends of both axles simultaneously an equal degree toward each other at one side of the vehicle and correspondingly diverging their opposite ends at the other side thereof, whereby full control of the turning either side thereof is insured and danger due to loss of control is avoided.

Designs.

DESIGN FOR A CIGAR OR CIGARETTE HOLDER.—A. Q. WALSH, New York, N. Y. This design includes two figures of a holder. Both are ornamented their entire length beyond the mouth end by an attractive plant and flower design. The particular difference is in the mouth ends of the holders, one being rather straight and slightly flattened and the other narrowed into a bottle neck shape and then broadening at the orifice of the mouth end.

DESIGN FOR AN ORNAMENT FOR GARMENTS.—A. IRELAND, New York, N. Y. This ornamental design represents a long bodied animal without limbs of any kind, the body tapering from a very bushy head to the tail, which spreads out at the end.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th, 1909, or will be sent by mail on request.

(12228) E. A. P. says: Does an article weigh the same at the equator as at the poles of the earth? If not why not? How much difference would there be? A. For two causes a body will weigh more at the poles than at the equator. One is that it is nearer the center of the earth, the other is that the rotation of the earth on its axis lightens bodies at the equator but not at all at the poles. This is called centrifugal force. The weight of a body at the poles is 994.978 of its weight at the equator, or about 5 pounds in 1,000 pounds.

(12229) W. H. B. says: To photograph the vibrations of the diaphragm of a phonograph by a narrow beam of light thrown on a photographic film, say one half inch in width, contained on two spools and moving in unison with the phonograph, said film to be afterward developed and then used as a reproducer on a photographic machine, the wires of which have a small selenium connection, and a narrow beam of light being thrown through the film of the selenium and connected with the ordinary telephone reproducer. The vibrations could be photographed in a number of ways. A small mirror could be fastened to the phonograph and reflect the beam of light on the film. A diaphragm could be made so that it would open and close in unison with the vibrations. In fact there are a great many different ways, as I have said before, in which this could be accomplished, but whether the vibrations would be of such a nature, or the celluloid film pure enough so that the interruption of the electric currents produced by the light shining through these vibrations would make a practical instrument, is beyond me without working it out. The drawbacks to the present phonograph are the shortness of the record and the scratching of the needle. If it were possible to transfer the vibrations of sound into light and photograph them on the film, as I have stated above, the period of the phonographic record could be greatly lengthened, and of course there would be no scratching from the needle itself. A. We should not dare to say that a photographic film could not reproduce sounds, but it does not seem to us to be probable that it could do so. It would seem to us almost certain that selenium could not vary rapidly enough to produce a record of a sound. Certainly if a mechanical shutter were worked fast enough to be in unison with the vibrations the shutter would emit the same tone as the sound, and it is not obvious how a shutter could change its rate of opening and closing to keep in unison with all the tones of the sounds. There is a phonograph which employs magnetism and magnetizes a rapidly moving wire so that it will reproduce speech or music which has been said or sung into it most perfectly and without any rasping or disagreeable sounds such as all other phonographs have. A length of wire can be used which will permit a whole discourse of an hour to be taken upon it.

(12230) A. M. asks: While I was in New York a few years ago taking in the statue of Liberty, I was told that the copper sheathing of the statue was insulated from the steel framework to protect the one metal from the other in some action of destruction. I have noticed that some lightning rod manufacturers use a combination of steel and copper and the thought struck me that the same destruction would occur in such rods. Will you be kind enough to explain what action causes the destruction and to what extent? A. Copper and iron are two metals between which an electromotive force is set up when they come into contact with each other, producing an electric current. This current causes an eating away of one of the metals, and thus the statue of Liberty would be gradually destroyed if the copper sheets were riveted directly to the iron framework. The action is very slow, but the statue was intended to endure for a very long time. The joints of a rod of these two metals would in time become loose for the same reason. This process is called electrolysis.

(12231) J. L. B. asks: Will you please tell me how to transform a 110-volt alternating current to a direct current of 8 or 12 volts? I wish to use the electric light current in my house to ring door bells and to operate small motors. A. You will find the descriptions of rectifiers in our SUPPLEMENTS 1748 and 1644, price ten cents each. One of these will give you direct current for ringing a door bell.

(12232) A. R. K. says: Will you please tell the difference in the quality or character of the primary and secondary current of the induction coil? The current seems to be intensified or augmented, but what in volts, amperes or electromotive force? Would the secondary current operate an electromagnet? A. In an induction coil, such as is used for producing sparks or working X-ray tubes and wireless telegraph apparatus, the primary current is of low voltage and is interrupted many times a second. It is an interrupted direct current. The secondary coil has a current of much higher voltage, and if the terminals are quite a distance apart and a condenser is used, the secondary current is also always in the same direction. The terminals of the secondary are plus and minus, but do not change their sign unless the direction of the primary current is changed or reversed. The secondary current will not usually operate a motor, nor can it be used on an electro magnet.

(12233) G. T. says: Why is it that the winds are not utilized as a source of power for practically all purposes? Why, for instance, could I not light and heat my house with electricity derived from the force of the winds? A. There is no reason whatever why you should not heat and light your house with wind power if you had enough wind and enough plant. The only reason why windmills are not more so used is that there are few places where wind is sufficiently constant to provide continuous power, and if no auxiliary engine is used to run the plant when there is no wind, the capacity of both windmill and generator must be greatly in excess of normal requirements in order to generate enough power when the wind blows to serve for longer periods of calm. The storage battery capacity must be also very great. Probably the most convenient and cheap way is to have a large tank (in an attic or the top of a barn or on a hill) of capacity sufficient to run a water motor driving the generator for three or four days at least and a windmill pump of sufficient capacity to fill the tank in a day's continuous pumping or less.

(12234) F. L. P. writes: I know that a person has more or less electricity in him, but I have a question about myself. I am a school teacher. When writing on an ordinary plaster blackboard I generally receive an electric shock and a snap is heard. My classes recite in different rooms and this occurs in two but not in the third. It occurs in two rooms that are adjoining, but always on the south walls only. Could it be defective wiring in our lighting system? Could defective wiring give that kind of a shock? Is plaster a good conductor? Isn't it rather a poor conductor? I am generally able to discharge it

at the second touch if not the first and do not always notice it at the first touch In opposition to the defective wiring I have been able to find no one else in the class who ever notices the same thing although they can see me draw back my hand when I receive the shock Again I have noticed the shock and heard the snap when I passed something say a pencil from my hand to that of a student A It is doubtless true that some persons can generate sparks of electricity more easily than others You seem to be one of those who have that power We have always supposed that it was due to an unusual dryness of the skin so that the friction of the feet on the carpet or floor produced electrification to an unusual degree It is not uncommon in cold dry weather for a person to feel a slight pricking from a spark of electricity when he touches a wall or some object People can light a gas jet in that way We should not say that people have electricity in them any more than the earth has electricity in it Electricity or the ability to become electrified is common to all things Insulate anything and it can be electrified It is not necessary to suppose that the electric light wiring has anything to do with the phenomena If that were defective you would have trouble with the lights

(12235) W H McF says Kindly explain how an engine makes a curve when the outside rail is longer than the inside A When an engine on rails rounds a curve centrifugal force carries it toward the outer rail to some small extent causing the wheels which are tapered or cone shaped to run on a larger circumference on the outer and a smaller circumference on the inner rail The tapering of the wheels is not however sufficient to provide for all the differences between the length of the inner and outer rails and has lately been reduced and the remaining difference is overcome by the slip of the inner wheels on the rail when the pressure of the outer wheels is greater

(12236) J F says Could you give me a plain rule or formula for computing the time of rising and setting of the sun moon and stars through your Notes and Queries or otherwise, or refer me to a book that contains such a rule or formula? A The times of the rising and setting of the sun moon and *stars are found from spherical trigonometry* using the latitude of the place and the declination and right ascension of the heavenly body whose times are to be computed We do not know any short method for getting the result The methods are briefly given in Young's General Astronomy which we send for $4 post paid

(12237) H C M says Will you kindly give me information on the following point? Is it possible and if so by what formula to compute the volume of a gas passing through an aperture of known size having given the density of the gas its pressure and the pressure of the atmosphere into which it is discharging? A The theoretical velocity in feet per second of the flow of gas (or any fluid or liquid) through an orifice is $v = \sqrt{2gh} = 8.02\sqrt{h}$ in which h equals the head or [illegible] height of a column of the fluid in feet required to produce the pressure of the fluid at the level of the orifice $H = \frac{v^2}{2g}$

The quantity of flow in cubic feet per second is equal to the velocity multiplied by the area of the orifice in square feet and also multiplied by a coefficient of flow which takes into account the *vena contracta* of the flowing stream and the friction of the orifice etc Dr Julius Weisbach gives the following coefficients for flow from a vessel of pressure *p1* into a reservoir or atmosphere of pressure *p2* for circular orifice of 1 centimeter diameter When the ratio *p1* ÷ *p2* is 1.05 1.09 1.43 1.65 1.89 2.15

Coefficient of flow is 0.555, 0.580 0.692 0.724 0.754 0.788

(12238) N V says 1 I would like to have a copy of the naval telegraph code A We would suggest an application to the Secretary of the Navy for a copy of the naval telegraph code 2 How many batteries (dry) to run a 10 candle power incandescent lamp? A We cannot tell you how many dry cells will be required to run a 10 candle power incandescent lamp Take enough to furnish the voltage in series at 1.4 volts per cell and as many series as will bring the lamp to full brightness 3 Can you tell me how to prepare woods for collections (showing a cross grain face a bevel face a longitudinal face and bark)? A Woods are prepared for museum collections by sawing the sections as you describe and smoothing them carefully to bring out the grain One half of each part is usually varnished to show its appearance when polished

(12239) I N L asks As your paper is on our files here I take the liberty of submitting a bet that has been made here for your decision A bets that at the equatorial line the sun rises and sets at 6 A M and P M B bets that the changes in time vary same as here in Hawaii A personal note as to who wins this bet will greatly oblige A We do not decide bets. Our Hints to Correspondents have for a long time stated this plainly We will say that as viewed from the equator of the earth the poles of the heavens are upon the north and south points of the horizon. All circles of daily motion are perpendicular to the horizon and are bisected by the horizon. Every heavenly body is half of the day above the horizon and half of the day below the horizon Perhaps you can tell from this at what hour of the day the sun must always rise and set as seen from the equator

NEW BOOKS, ETC.

Rhodes's Directory of Passenger Steamers London George Philip & Son, Ltd, 1910 12mo, 387 pp Price, $1

This is a very valuable book for all who are interested in any way in shipping It gives a list of companies with the names of the vessels under each then comes a directory of passenger steamers giving the length breadth, depth horse-power etc, of all vessels. The writer has found this book of great value in comparing tonnages and horse power in disputed questions which have arisen There are a number of excellent illustrations in the front of the book The book is printed on light weight paper rendering it very convenient for reference It is attractively bound

The History of the Logarithmic Slide Rule and Allied Instruments By Florian Cajori, Ph D New York Engineering News Publishing Company, 1909 12mo 126 pp Price, $1

Of the machines for minimizing mental labor in computation no device has been of greater general interest than that of the slide rule, and few instruments offer a more attractive field for historical study The present monograph deals with the history and development of the slide rule in various countries There is too a complete list of all the slide rules designed and used since 1800, there is also a bibliography of books on the slide rule and altogether the work is a most interesting one The author is to be congratulated on the production of a unique book

The Engineering Index Annual, 1909 Compiled from the Engineering Index, published monthly in the Engineering Magazine during 1909 New York and London The Engineering Magazine, 1910 8vo, 471 pp Price, $2

For the past twenty six years the Engineering Magazine has been publishing a valuable index of engineering and technical literature, and for the last four years the Index has appeared annually In the present volume the classifications have been amplified and cross references freely used to assist a person in finding the literature he desires The index covers a long list of periodicals three fourths of which are printed in English while the others are German French Spanish Italian and Dutch A brief description is given in each case to define the scope and purport of the article

Technischer Fuehrer durch Wien Herausgegeben vom Oesterreichischen Ingenieur und Architekten Verein Redigiert von Ing Dr Martin Paul Stadtbauinspektor Wien Verlag von Gerlach & Wiedling, 1910

The general plan of this book seems to us most admirable It starts with "The General Development of the City of Vienna" under which general title are discussed geology and climate hydrography building material, statistics and government organization of the technical bureaus technical and industrial societies and city development The second division under the general title of Engineering Works includes papers on traffic, postal telegraph and telephone service streets and squares, drainage water supply illumination, bridges water works, parks and cemeteries abattoirs and provision houses. The third division under the general title of Architectural Works discusses the development of Viennese architecture within the last fifty years buildings for art purposes buildings of the imperial court administration buildings educational buildings hospitals and asylums military structures club houses museums exchanges and business houses exposition buildings The fourth division on plastic art and art collections, discusses monuments and public buildings collections and libraries Under the fifth and last division the general industrial activity of the city is discussed

The Flow of Water D Van Nostrand Company 1909 8vo, 228 pp Price, $3 net.

The present work is the outcome of a series of investigations begun several years ago with the object of finding a simple expression for the phenomenon of flow in irrigation channels The author hopes that his work will prove of interest and value to the student and useful to the practical engineer He also hopes that it will stimulate further research and thus tend to widen the field of hydraulic knowledge

The History of the Typewriter. By George Carl Mares. London Guilbert Pitman, 1909 8vo, 320 pp

There are surely few people nowadays who are not acquainted with the typewriter either directly or indirectly but how many are aware that *some three hundred different forms* of writing machines have made a bold bid for public favor since the introduction of the first practical machine in the early seventies? In the "History of the Typewriter," in the compilation of which the author has been occupied for upward of five years, is presented for the first time in English literature a complete record of the invention and development of the writing machine In the 320 pages nearly 400 machines are described with the aid of 230 illustrations—from the Mills typewriter of 185 years ago to the adaptation of typewriting to the uses of wireless telegraphy In this volume the Beach typewriter, invented by the late A E Beach, comes in for a proper share of attention

Insect Wonderland. By Constance M Foot New York John Lane Company, 1910 Price, $1 25 net

The kind reception given to the author's little book entitled "Science Through Stories" emboldened the writer to choose for the subject of this volume some simple facts concerning the insect world, and she has selected one or more specimens of each of the seven great orders of the insect world according to the Linnean system of division

The Care of Trees in Lawn, Street and Park By B. E Fernow New York Henry Holt & Co, 1910 392 pp Price, $2 net

The author may be well said to be the father of forestry in the United States, and those who have followed him are very deeply indebted for the splendid foundation which he laid The book belongs to the American Nature Series. Written for amateurs by a forester, this conveniently arranged volume furnishes information such as the owner of trees may need Trees in place may be rendered almost imperishable by proper care and attention and the author gives details of the best methods of caring for the health of trees, transplanting combating diseases and insects, etc There are systematic and exhaustive lists *of trees and shrubs fit for ornamental planting* with helpful notes on their adaptations.

Ignition Timing and Valve Setting By Thomas H Russell, M E, LL.B Chicago The Charles C Thompson Company, 1909 16mo, 223 pp Price, $1 in cloth $1 50 in leather

This is a comprehensive illustrated manual of self instruction for automobile owners, operators and repair men The following are the contents Electrical Ignition for Motor Car Engines The Magneto System Another View of Ignition Magneto Ignition, General Summary of Ignition Ignition Faults and Hints, Induction Coils, Timing Ignition, Valves and their Function and Valve Setting

Indian Birds Being a Key to Common Birds of the Plains of India By Douglas Dewar London and New York John Lane Company 16mo, 228 pp Price, $2 net.

The object of this book is to enable those interested in Indian birds to identify them at sight There are several good systematic works on Indian ornithology, but the systems presuppose that the reader has the specimen in his hand and is enabled to examine it leisurely feather by feather To do this it is necessary to kill the bird in question, a procedure which gives pain to many and gives pleasure to very few The method which the author employs is to classify birds according to their habits and outward appearance Each bird has a color and most birds possess some anatomical peculiarity such as a crest a long tail long legs, etc When the reader thinks he has located a bird he should turn to the descriptive list which composes Part II of the book This will serve to confirm or correct him in his identification

Our Search for a Wilderness By Mary Blair Beebe and C William Beebe New York Henry Holt & Co, 1910 8vo, 408 pp Price, $2 75 net

This volume is an account of two trips made by Mr and Mrs Beebe into tropical wildernesses The first was undertaken on a small Venezuelan sloop with which they penetrated far into the unknown Mangrove jungles, north of the Orinoco Delta, peopled principally by monkeys, Scarlet Ibises, and huge Anacondas This trip ended at La Brea—the great lake of pitch—at a most critical time, when the American company had just been ousted by Castro and Venezuelans put in charge The second search was in the Wilderness of British Guiana, where birds and animals, gold mines and Carib Indians all contributed continual interest and excitement This pioneer exploration by an ornithologist and his wife reveals the tropics as far more delightful and bearable than the writings of most travellers would lead us to believe

Exporters' Encyclopedia 1910 Edition. New York Exporters' Encyclopedia Company, 1910. 776 pp. Price, $5

The Exporters' Encyclopedia is now in its sixth year and is recognized as a standard authority among export shippers, and has the strong indorsement of all the transport lines, manufacturers, etc engaged in export trade The "correction notes" are published in the Exporters Review and are sent to each subscriber about the 15th of the month This enables the book to be kept up to date until a new issue is ready

A Formula Book of English Official Historical Documents. Part II Ministerial and Judicial Records. Edited by Hubert Hall F S.A. Cambridge University Press, 1909 8vo.; 229 pp. Price, $2.50.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE

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THE ACCIDENT TO THE "ZEPPELIN."

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"Zeppelin IV" did not involve the loss of any life. The "Republique" catastrophe, however, was tragic. On September 25th, 1909, the craft dropped from a height of about 200 meters to the earth, and its passengers, Capt. Marchal, Lieut. Chauve, and the mechanicians, Vincennot and Reau, were killed immediately. The disaster was occasioned by the breaking of a propeller blade which flew off the shaft and pierced the gas bag.

The 'Zeppelin II,' whose untimely end has been described, was taken over by the army last year, and made a member of the German airship fleet. The vessel took part in last year's airship maneuvers at Cologne, where it was stationed in the spring of 1909 the vessel made a long journey from Lake Constance to Bitterfeld and return, remaining uninterruptedly in the air 38 hours, until it collided with a pear tree at Goeppingen, and was partially damaged. The 'Zeppelin II' had a volume of 15,000 cubic meters. Its length was 136 meters, and maximum diameter 13 meters. Its maximum absolute velocity was 12½ meters a second, or 28 miles an hour. Its carrying capacity, including passengers and supplies, was 8,800 pounds. It was provided with two cars. The two motors of the airship developed each 115 horse-power. The total weight of the "Zeppelin" was about 23,100 pounds. The balloon frame, rigging and keel, balloon fabric, gas bags, stabilizing planes and meters, weighed 13,200 pounds. The seventeen gas cells weighed about 2,500 pounds.

Fire Control in the National Forests.

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of way during the fire season, while the work of clearing the strips in a satisfactory manner, including the disposition of all refuse, is to be done by the railroads but under the supervision of the Forest Service.

One of the most potent reasons why this agreement is a good one is the fact that the courts have decided the right of the Department of Agriculture to collect damages from roads running through National Forests for fires which they cause, and this fact is a strong inducement for the roads to join with the department in the effort to keep fires down.

Another strong factor is the fact that the Northern Pacific, being a land grant road, owns considerable timber on the alternate sections along its line. The Great Northern, although it is not a land-grant road, also has property at stake in its buildings and the line itself whose operation may be seriously interfered with by forest conflagrations.

The value of heavy timber in mountainous regions as a deterrent to avalanches, landslides, and floods is also to be considered. From the standpoint of far-sighted business policy a still broader argument is the relations of the forests to the general welfare of the regions whose traffic the roads handle. Timber which goes up in smoke pays no freight tolls and unchecked forest devastation means the enfeeblement of many industries dependent on wood and water.

Practical Sterilization by Means of Ultra-Violet Rays.

There seems to be little doubt according to The Lancet, that the germicidal action of the ultra-violet rays will shortly be made available for the purposes of practical sterilization. In what exact way the ultra violet rays act is not certain, but one view is that they produce ozone. Whatever the nature of the action may be, it seems clear that their application for the purpose of sterilizing articles intended for human consumption will eliminate the objection to the use of chemical antiseptics, the effect of which upon the human organism may be harmful. In an interesting paper which has reached us on the Sterilization of Water by Means of Quartz Lamps, by Dr Max von Recklinghausen, it is stated that work on a very large scale has lately been done in France on this subject, and has developed the entire system of sterilization of different liquids used for alimentary purposes, based on the effect of the ultra-violet rays created in Cooper Hewitt lamps made from transparent quartz. The chief work in this line has been done by Prof Henri in the Physiological Laboratory of the Sorbonne together with Dr André Helbronner, who co-operated with Dr Max von Recklinghausen with a view to developing an entire sterilizing system of the type described. The preliminary work was done by studying the action of the ultra violet rays on different types of microbes and the influence of the different wave lengths. Dr Roux of the Institut Pasteur in which a good many of the experiments were made presented to the Académie des Sciences some of the work done by the above cited scientists. Technically speaking the results so far have been the development of a small water sterilizer for hospital use whereby 132 gallons of sterile water are produced per hour from ordinary city water by means of one Cooper Hewitt lamp type "Silica," absorbing three amperes at 110 volts. Within a short time a very large sterilizing outfit based on somewhat similar ideas will be running which will sterilize 3,500 cubic feet of water per hour, this being large enough to treat the entire water supply of a town of about 10,000 inhabitants. The installation of the lamp it is stated, is a matter of no difficulty all that is necessary being to connect up to the terminals provided in the dome top of the apparatus and to make the adjustment necessary for the voltage of the particular circuit. In order that the supply of water delivered from the apparatus may be absolutely sterile or sterile to any required degree it is necessary that there should be means of dealing with the various water pressures met with in different districts. To accomplish this purpose the inlet pipe is fitted with an adjustable valve of special pattern which can be readily set, so that when full open the delivery from the apparatus does not exceed the quantity specified this in the case of requirements being for absolutely sterile water, being 132 gallons per hour. The water enters the chamber formed by the outer cone with a swirling motion. At the top of this cone it overflows and finds an outlet at the bottom of the inner cone up which it rises and flows out at the discharge pipe. The swirling motion is maintained during the complete passage of the water through the apparatus in order that it may be thoroughly stirred up and all microbes presented to the action of the light the water coming under its influence on two distinct occasions. Draining cocks are provided on the apparatus to enable it to be thoroughly emptied should circumstances arise whereby it would not be used for a considerable time. Not only does this system provide in the case of the apparatus under discussion a continuous supply of sterile water available within five minutes, but the water or any other liquid that may be treated is unaffected as far as taste is concerned as it retains all natural gases and salts in solution. The work of Prof Henri, Dr Helbronner and Dr Recklinghausen has also been directed towards the complete sterilization of milk, and this they have also accomplished. The apparatus for this purpose is more difficult to build than that for the treatment of water. Water is very transparent to ultra-violet rays, milk however is practically opaque to these rays, and special precautions have to be taken so as to bring it thoroughly under their influence.

A New Process for the Prevention of Coal-Dust Explosions.

The production of coal dust in mines is due to the shattering of the coal when it is separated from the face of the work ing by the blast. The current of air

which passes through every coal mine from one ventilating shaft to another carries the dust into every part of the galleries, which may extend for several miles The distribution of the coal dust is further increased by the conveyance of coal in the mine cars, which usually move in a direction opposite to that of the air current, so that much dust is blown from them The dust settles in the corners and on the projections of the walls of the gallery, and especially on the floor and the tops of the timbers.

If the mixture of air and suspended coal dust comes into contact with a sufficiently hot flame a combustible gas is suddenly generated from the coal dust This gas, known as methane, or marsh gas is not explosive, except when it is mixed with air, in which condition it explodes with fearful violence The shock of the explosion scatters in the air much of the coal dust which has settled on the floor and elsewhere, and the heat produced by the explosion distills from this suspended coal dust a fresh quantity of methane which comes into contact with the flame In this manner the explosion is propagated from point to point, often throughout the entire mine

The possible means of preventing such extensive explosions of coal dust are confined to preventing the dust from rising in the air, and to disposing of the heat produced by the initial explosion so effectually that the further distillation of the coal dust and the formation of gas are prevented The heat produced by the initial explosion may be consumed in the evaporation of incombustible liquids, distributed through the workings The greater the quantity of such volatile liquid, and the greater the extent of surface exposed to the wave of explosion, the more rapid and effectual is the absorption of heat. The liquid used for this purpose at present is water It is necessary to wet or sprinkle every part of the mine in which coal dust exists This precaution is enforced by law in Germany and Austria but not elsewhere even in England, America, or France Most of the water applied to vertical surfaces quickly runs off, and the little that remains adhering to the surface evaporates in a few hours The effect persists a little longer on the floor of the gallery and other horizontal surfaces, but even the paste of coal dust and water that is formed on the floor soon becomes dry Hence the application of water must be frequently repeated Too frequent watering however, is injurious to the operation of the mine The water soaks into the porous rock and loosens it, causing danger of caving In very hot mines, the rapid evaporation of the water produces an exceedingly damp atmosphere, which is very injurious to the efficiency and health of the miners

The Kruskopf process for the prevention of coal dust explosions, which has recently been patented in Germany, employs instead of water a viscous paste, of such chemical constitution that it does not evaporate appreciably under the influence of the normal air current, but evaporates rapidly when exposed to the heat of a small explosion Owing to the adhesive character of the paste, it can be applied to all surfaces horizontal vertical and inclined and in about eight times the quantity which is possible in the case of water The thick paste, furthermore, does not soak into the rock and as it does not evaporate in ordinary conditions it does not increase the humidity of the atmosphere It has been proved by experiment that a coal dust explosion which in its nature is progressive, can be arrested by applying this mixture to the first hundred yards of the gallery this distance being sufficient to cause the explosion to die out owing to lack of explosive material In the actual conditions of mining the original ignition of coal dust takes place in almost every case, at the face of the

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working, and the explosion is propagated thence through the gallery to the shaft. Hence, by applying this paste to a small region near each working, it is possible to confine the explosions to the workings themselves and to protect the rest of the mine, without the necessity of applying the same precaution through miles of galleries. This fact greatly reduces the expense and trouble involved in the method. Practical experiments in a Westphalian mine and in an experimental gallery have proved the correctness of the theory upon which this process is based. In the mine, the walls remained damp 3,000 hours after the application of the paste, but they dried up within six hours when water was used. The explosion of 75 grains of dynamite produces a sufficiently powerful flame to explode a mixture of coal dust and air when the walls of the gallery are dry, and for this reason the use of dynamite in coal mines is prohibited by law. The experiments prove that in a mine gallery protected by the Kruskopf process, more than five ounces of dynamite can be exploded in a mixture of coal gas and air without causing ignition. The experiment was repeated twelve times. After each blast, the quantity of coal dust in the mixture was increased by the addition of a fixed amount of dry dust, but the application of the paste or of water was not renewed. In these conditions, when water was used, ignition took place after the third blast, but the first faint explosion occurred after the twelfth blast when the Kruskopf paste was employed. These conditions are very much more unfavorable than those which occur in the practical operation of coal mines.

Colors of Foods.

Of the strong addiction many consumers have for the use of foodstuffs that are secretly and highly colored for the market, the London Lancet says:

"For some not quite clear reason there are many people who look upon the brown egg as necessarily a new laid one, and hence a fair demand for brown eggs has arisen, which is easily met not by the honest brown egg, but by the white egg which has been steeped in a dye which renders it visually indistinguishable from the real article. Again, when milk happens to be of a buff tinge, it is commonly held to be richer than white milk. Of course nothing can be easier than to satisfy this preference for a milk of a creamy shade. White-looking butter is disliked as looking too much like dripping. The remedy is simple, it is artificially colored. Vegetables must be bright green to make them look fresh, the consumers of them being quite willing to ignore the fact that copper does not make them fresh or wholesome. On the other hand, curiously enough, bread must be white.

"It is, of course, perfectly natural to take color as a criterion of the dietetic value or flavor of food, and the attractive or unattractive appearance of food may make all the difference as to whether that food is, or is not, assimilated properly. The deceit which is practised by artificially coloring food may thus serve a useful purpose, so long as the coloring matter is harmless, but as a rule the proceeding is an immoral one. It does not follow that because food is unattractive its value as a food is nil, while every form of sophistication is open to commercial abuse. A correspondent last week submitted to us a brown-shelled egg which on opening displayed a gorgeous red coloring scattered chiefly through the white. On analysis the coloring proved to be an anilin dye. The dye had deposited a nice brown on the shell, but an excess had permeated its pores, and, meeting with the slightly acid contents, was changed to a port-wine color inside. Until the egg was opened, therefore, it appeared perfectly attractive, but on opening it the zest to eat it quickly disappeared."

HALLEY AND HIS COMET

The year 1910 is destined to be one of the most famous in astronomical history, simply because Halley's comet has returned after a lapse of seventy-five years. Why not learn all about this wonderful comet and about comets in general by reading the following articles?

Scientific American No 19, Vol XCVIII **Gas Phosphorescence and Meteor Trains.** An article in which the investigations of C C Trowbridge of Columbia University are described, showing that the after-glow produced from a vacuum tube resembles closely the effect produced in the sky by the passage of meteors

Scientific American No 6, Vol XCIX **The Mystery of Comets.** An article in which the famous comets of the last century are enumerated and described and modern cometary theories discussed

Scientific American Supplement No 1728 **Ancient and Popular Ideas About Comets.** Queer superstitions about the strangest of heavenly bodies

Scientific American No 7, Vol CI **Halley's Comet.** An interesting article by Dr Alexander W Roberts, in which the general history of Halley's famous comet is sketched with comments on its past appearances.

Scientific American Supplement No. 1705. **The Next Apparition (1910) of Halley's Comet.** An important article by H C. Wilson, with a map giving the position of the comet relatively to the orbits of the planets from September 15, 1908, to July 13, 1910.

Scientific American Supplement No 1632. **Halley's Comet.** An article by F W Henkel, F R A S., which tells how Halley came to discover the comet which bears his name, and how mathematicians have plotted its orbit

Scientific American Supplement No 1770. **Edmund Halley.** A biography by J E Gore, M R I A, of the man who dispelled cometary superstitions and popularized the law of gravitation.

Scientific American Supplement No. 1773. **Light Pressure and Comets' Tails** An explanation of the vagaries of a comet's tail, by Arthur Stanley Eddington, F R A S

Scientific American Supplement Nos. 1788 and 1789. **Halley's Comet.** By George F Chambers, F R A S The most thorough article which has thus far appeared on Halley and Halley's comet.

Scientific American No 13, Volume CII. **Condensed Facts About Halley's Comet.** By H W Griggs. A few facts presented in condensed form for those who wish to follow the course of Halley's comet in the heavens. Maps showing the apparent path of Halley's comet through the heavens and the relation of the orbits of Halley's comet and the planets.

Scientific American No 16, Volume CII. **Halley's Comet at its Brightest.** By Professor Henry Norris Russell. A simply worded astronomical article telling how Halley's comet was discovered on its present return, when it will appear at its brightest, where to look for it, what it is composed of, etc

Scientific American No 18, Volume CII **How to Make a Model of the Orbit of Halley's Comet, Showing its Relative Position to the Earth's Orbit.** Designed by James K Lynch By means of this model many of the phenomena of Halley's comet can be explained.

Scientific American Supplement No. 1772 **Photographing Comets.** By R. E. Barnard, of Yerkes Observatory A practical article on how to photograph Halley's comet

Scientific American Supplement No 1778. **Halley's Comet.** An article in which the suggested observations proposed by the Astronomical and Physical Society of America are given, so far as photography and spectroscopic observations are concerned

Scientific American Supplement No. 1782 **Halley's Cometary Studies.** Halley's own account of his investigations on orbits.

Scientific American Supplement No. 1785. **Halley's Comet as Seen from the Earth.** A table prepared by the distinguished Greenwich astronomer, P H. Cowell, giving the ecliptic co-ordinates of Halley's comet to two decimal places at intervals of four days through an arc extending from one end to the other of the latus rectum of its orbit. The figures apply approximately to any return.

Scientific American No. 10, Vol CII **Could the Earth Collide with a Comet?** An examination of past comet scares and the general possibility of collision of a comet with the earth.

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Siphon attachment for bathing purposes, E D. Knickerbocker [illegible]
Siphon closet, C H. Christensen [illegible]
Slate picker, C B. Farrer [illegible]
Smelting furnace J Grogan [illegible]
Smoke consumer, T Rees [illegible]
Snow plow, rotary, W. K Ferguson [illegible]
Soap cutting machine, E. G Sholes [illegible]
Soap dispenser, W B. Garnett [illegible]
Sodium aluminate, making, F. A. [illegible] [illegible]
Sodium sulfite and ammonium chlorid, making, Friedrich & Hirsch [illegible]
Soldering implement, H J Greene [illegible]
Soldering iron, electric H. W Mire, Jr. [illegible]
Soldering machine, hand, A Tosco [illegible]
Soldering tool A A. Bedard [illegible]
Sole cutting and marking machine, M Cook, Jr. [illegible]
Sound reproducing machine, disk, T H. Macdonald [illegible]
Sounds, recording and reproducing, J. O. English [illegible]
Sower, seed, R. Schooner [illegible]
Spark plug oil proof, R J Bailey [illegible]
Speed retarding and reversing device, K. J. A. Isaksen [illegible]
[illegible], D. M. Bell [illegible]
[illegible], Henley & [illegible] [illegible]
Spinning, [illegible], etc., [illegible] mechanism for, Ayer & Davis [illegible]
Sprinkler, [illegible], C. E. [illegible] [illegible]
[illegible]

Stitching indicator, presser foot for shoe sole, H. Michelson 957,697
Stocking for [illegible], mechanical, F. G. Armstead 957,896
Stopper retainer, A. C. Boggs, Jr. 957,646
Stove, baking, J. A. Coppridge 957,748
Stove burner, J. L. Park 957,565
Stove, cooking, E. Barber 957,642
Stovepipe holder, W. E. McCune 957,071
Stropper. See Razor stropper
Stuffing box, gasket, valve, and spring, combined, G. L. Kennedy 957,747
Stuffing rod, O. Brookman 957,737
Suction box, King & Neary 957,217
Sulfur burner, P. H. Grimm 957,418
Swing, gliding, F. S. Spaulding 957,653
Tagging machine, F. W. Hall 957,430
Tailing machine, R. L. Gibson 957,396
Tanks, pneumatic pressure apparatus for water, Carter & Maull 957,304
Tanning apparatus, J. B. Koegler 957,380
Target, moving, P. Chiantore 957,744
Telegraphic keyboard transmitting apparatus, P. B. Delany 957,312
Telephone apparatus, C. F. Bradburn 957,489, 957,490
Telephone mouthpiece, A. Rehout 957,404
Telephone receiver, N. Baldwin 957,405
Telephone system, C. F. Bradburn 957,491
Telephony, transmitting system for space, V. H. Laughter 957,809
Tent frame, A. Juin 957,215
Thread trimming mechanism, H. W. Slater 957,265
Tile board, G. F. Chappell 957,189
Tile cutting machine, J. Benning 957,488
Tile, forming, G. F. Chappell 957,187
Tile, forming ornamental, G. F. Chappell 957,188
Time controlling mechanism, H. C. Wilcox 957,798
Tire grip, A. R. Corrington 957,300
Tire sleeve fastening apparatus, P. B. Donahoo 957,813
Tire, protecting cover for pneumatic, A. Constantin 957,413
Titanium nitrogen compounds, production of, C. Roach 957,842
Toilet seat, collapsible, Vanosdall & Knick 957,822
Tool, C. C. Tainter 957,271
Torch, vapor, T. Yates 957,292
Torpedo, M. Glass 957,070
Tow lines, surge reliever or safety device for, W. A. Duncanson 957,313
Toy, G. H. Ulbrich 957,819
Track, elevated, J. C. Fitzgerald 957,757
Track sander, C. P. White 957,482
Tracker board, universally movable, M. F. Holderman 957,670
Transmission system, J. Schilz 957,263
Tree felling machine, J. B. Wise 957,882
Trolley guard, F. B. Wagner 957,865
Trolley wheel, O. R. Chew 957,665
Truck barrel, C. Bjorklund 957,840
Truck, lumber, S. B. Merry 957,431
Trucks, basket attachment for barrel, C. Bjorklund 957,406
Trunk, C. A. McCarthy 957,704
Truss bar, P. R. & R. L. Bertin 957,181
Tube bending machine, J. F. Gail 957,199, 957,200
Tube mill, B. L. Morrison 957,430
Tunneling machine structure, J. P. Karns 957,697
Tunnels, smoke exhausting device for, P. H. Wedmark 957,798
Turbine, multistage, F. Hodgkinson 957,338
Turbo generator, direct current, B. G. Wright 957,290
Twine holder, C. F. Layman 957,508
Typewriter back spacing mechanism, H. Raymond 957,370
Typewriting machine, E. E. Barney 957,178
Typewriting machine, H. H. Steele 957,388
Typewriting machine, O. Woodward 957,289
Typewriting machine, F. A. Young 957,201
Typewriting machine, C. B. Yaw 957,402
Typewriting machine, W. C. Paul 957,624
Typewriting machine, H. Crutchley 957,740
Umbrella, folding, G. A. Bratsel 957,734
Umbrella part, F. Wetteroth 957,327
Undergarment for women, M. Millard 957,380
Vacuum supporting device, F. P. Schroeder 957,804
Vacuum trap, L. P. Strong 957,289
Valve, C. A. Ellis 957,318
Valve, R. E. Sweet 957,801
Valve, H. P. Allen 957,782
Valve, C. F. Strong 957,611
Valve chamber for water columns, F. C. Anderson 957,533
Valve, distributing and reversing expansion, W. M. Coward 957,490
Valve for internal-combustion engines, F. W. Brady 957,730
Valve for steam traps, C. J. Mackerey 957,470
Valve for steam traps and the like, C. J. Mackerey 957,469
Valve, gas engine, R. White 957,285
Valve, irrigating, E. R. Iser 957,777
Valve motion for steam engines, slide, E. Frikart 957,762
Valve, piston, J. T. Wilson 957,246
Valve, pressure controlling, F. A. Lockwood 957,511
Valve, radiator, E. P. Allen 957,783
Valve, stop and check, Davis & Daley 957,311
Vaporizing device, A. A. Low 957,786
Vegetables and partially cooking the same, washing, E. J. Judge 957,466
Vehicle brake, V. T. Sweeney 957,632
Vehicle driving mechanism, J. F. Waite, reissue 13,113
Vehicle wind shield, Bertram & Lamoreaux 957,041
Vehicles, folding hood framing for road, P. W. Watson, Jr. 957,827
Vending machine, coin operated, J. Starr 957,720
Ventilator, L. Johanns 957,080
Vessels, apparatus for locating sunken, G. B. Lee Quee 957,223
Violins and similar stringed musical instruments, keyed finger board for, A. T. John 957,081
Vise, E. C. Stearns 957,320
Voting machine, W. Glenn 957,320
Wagon jack, M. G. Colby 957,308
Wagon rack, detachable, J. Weber 957,596
Walls, apparatus for building retaining, F. H. Talbot 957,821
Washing machine, W. H. Preston 957,475
Washing machine and boiler, combined, M. McKeen 957,861
Watch maker's and repairer's tool, B. N. Mann 957,[illegible]
Water heater, H. T. Rauer 957,[illegible]
Water or solution from solids, such as slimy ores, pulp, and the like, means for separating, W. J. Holmes et al 957,775
Weather strip, C. H. Faulkner 957,540
Wells, electric heater for oil, O. B. Linquest 957,785
Wheel. See Gapped wheel
Whiffletree, W. V. Gist 957,361
Whistle, siren, or the like, L. A. Delpeuch 957,661
Windage losses, means for decreasing, J. K. Noeggerath 957,248
Winder, skein, V. Lafont 957,427
Window, W. L. Bliss 957,724
Window construction, Lanken & Conklin 957,693
Windows, dust and air guard for, O. C. Call 957,498
Wire bending machine, W. H. Parker 957,245
Wire clip, O. A. Bellveau 957,485
Wire drawing dies, cooling attachment for, J. A. Horton 957,464
Wire netting weaving machine, C. R. Begg 957,643
Wire structure, Melish & Gatch 957,619
Wrench, R. W. Armstrong 957,728
Wrench, L. O. Lawrence 957,778
Writing machine, check, G. M. Barker 957,866
Yarn and the like, apparatus for opening and separating threads of, Keith & Wardle 957,610
Yoke, detachable neck, J. Barry, Jr. 957,179

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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First section of subways to be undertaken.

Chicago proposes gradually to place all tracks, surface and elevated, that enter the business zone, below street level. The above view shows a station on the new Wabash Avenue four-track subway. The trolley cars are to the right, the elevated express cars use the left-hand track. The lowest tunnel is the present 60-mile freight subway.

HOW CHICAGO IS SOLVING ITS RAPID TRANSIT PROBLEM.—[See page 439.]

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NEW YORK, SATURDAY, MAY 28th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

OUR NATIONAL GOOD ROADS LABORATORY

AMONG the less known, but by no means less important, sections of the broad field of activity covered by the Department of Agriculture, is that which comes under the Office of Public Roads. Although this office has no administrative duties and exercises no control over the roads of the United States—except, of course, those that are located on government reservations—it is doing most important work of a scientific and educational character.

The movement for Federal assistance in the promotion of good roads dates back to the year 1893, when a modest appropriation of $10,000 was made, to enable the Secretary of Agriculture to inaugurate the work. To date a sum of nearly half a million dollars has been appropriated, and if this year's estimate be included, the total reaches about six hundred thousand dollars.

A full account of the growth of this movement is presented on another page of this issue, and it gives us much pleasure to draw particular attention to that branch of the Office of Public Roads which is known as the Division of Tests. We make this special reference on account of the high character of its organization and work, and because one of our recent editorials would give the impression that no such division exists. As a matter of fact, this laboratory, as we are informed by Director A. W. Page, is not only equipped with the best and most improved apparatus used in European laboratories, but has developed a number of additional tests, such as those for toughness and cementing value. Routine tests are made on road-building materials free of charge for any citizen of the United States, and a large amount of experimental and research work is being carried on. Indeed, it is justifiable to state that the laboratory of the Office of Public Roads is the most completely equipped road material laboratory in the world, and that the number of samples tested yearly is far greater than in any similar institution. As a matter of fact, during the present year about three hundred typical samples of the road-building rocks of England, Scotland and Wales were tested by special request, in addition to the regular routine work.

ARBITRATION VERSUS SELF REDRESS.

AS surely as the duel has given place, among individuals, to the court of justice, will the awful arbitrament of war give way to the international tribunal; also, as a corollary to this, it may be written down that as the court of justice has back of it for the enforcement of its decrees the punitive machinery of the government, so will the international court be backed by some form of international police, composed of limited naval and military forces, in which each of the signatories to the international court will be represented.

One of the brightest auguries of the dawn of a world-wide peace is to be found in the fact that it has become the fashion, during the past year or two, to speak of armies and navies as means for the preservation of peace. When the leaders of the world, be they presidents, kings or emperors, declare that every increase in the armed strength of their respective countries is undertaken for the express purpose of preserving peace, the statement is generally accepted as sincere. Although the advocates of peace by arbitration deplore the enormous investment of treasure, time, and labor involved in the maintenance of the vast military organizations of the civilized world, they are beginning to believe that the advocates of peace by war are as anxious as they themselves that the world's peace be permanently preserved.

The establishment of the noble principle of international arbitration will be, after all, merely a repetition in the international world of a process of evolution from barbarism to civilization, which has long ago taken place in the individual national world. Far back in the beginnings of human history, the principle of self-redress was paramount. If wrong or fancied wrong was done, the injured party encompassed the death of his enemy by such ready means as might be at hand. Gradually, with the growth of intelligence, it was realized, not only that the injured party was but a poor judge of his own cause, but that the principle of self-redress was subversive of the peace and happiness of the community. It was realized, also, that the man whose brain was clouded with the smoke of furious passion, was not so well qualified a judge as some third and disinterested party, who could look upon the case in dispute with an impartial eye, and so, gradually but surely, the principle of arbitration took shape and became the stable rock on which our wonderful modern system of national jurisprudence has been erected.

We have before us a lucid review of the growth of the principle of national arbitration in a pamphlet published by the Maryland Peace Society and written by James Brown Scott, lecturer on international law in the George Washington and Johns Hopkins universities. He refers to the three stages which were shown in the development of the celebrated Roman judicial system, which were as follows: (1) The private litigant submitted his controversy to an arbiter of his own choice for decision according to the conscience of a good and impartial man. (2) the magistrate or judge chosen from an official list or panel is preferred to a citizen arbitrator, (3) the administration of justice is regarded as the duty and therefore the right of the State and a judicial system is prepared for and imposed upon the citizen.

The author of the paper sees the same unconscious development taking place in the gradual growth of arbitration between states. In early times they would choose as arbiter the Pope, in modern times, some foreign sovereign. The lack of continuity of decision in this system, which dealt with the individual case, led up to the second stage, dating from the first conference, which involved the appointment by international action of a panel of judges, from which judges forming the temporary tribunal are chosen. 'We stand,' *says the writer*, "upon the very threshold of the third and final development, when nations as a whole determine that international justice is the province of the international community and constitute a court of international justice to which litigant states may resort in conflicts of importance.' To-day much has been done. The organization, jurisdiction and procedure of this international tribunal have been *determined. Now, we merely await the appointment* of judges to establish a world-wide court, in which the nations may obtain justice as easily and readily as private suitors in national courts of justice.

The author of this paper does not go into the question of the enforcement of the findings of international arbitration. It is our belief that an international court should be backed by an army composed of drafts *from the various armies of the world previous* to their disarmament, limited in numbers and existing solely for the enforcement of its decrees.

SIR WILLIAM HUGGINS AND HIS WORK

WITH the death of Sir William Huggins there passed away an astronomer whose pioneer work in the field of astro-physics has earned for him an enduring place in the history of science. It was largely due to Sir William's genius that the spectroscope became an *instrument of astronomical investigation* hardly less important than the telescope. His work was done so many years ago, and its results have been so far-reaching, that it is easy enough to value it at its true worth.

Huggins began his studies shortly after Kirchoff applied the terrestrial science of spectrum analysis to the study of the sun. Partly as a result of *Huggins's efforts* astronomers have been enable to observe the solar prominences at any time, without waiting for an eclipse, for the principle of spectroscopic visibility of prominence lines at the edge of an uneclipsed sun was quite explicitly stated by him in February, 1868. He even devised various instruments for bringing the prominences into actual view. His use of the 'open slit" on February 13th, 1869, may be said to have begun the modern study of solar prominences. Before the days of the "open slit," prominences had been examined only in sections.

The first tangible results in the estimation of movements of approach and recession between the earth and the stars, by means of Doppler's principle, were communicated by Sir William Huggins to the Royal Society on April 23rd, 1868. Application of this method to the stars is encompassed with difficulties; for it needs a powerful dispersive spectroscope to show a minute line of displacement, and powerful dispersion involves a strictly proportionate enfeeblement of light. Selecting the brightest star in the heavens as the most promising subject of experiment, Huggins considered the F line in the spectrum of Sirius to be just so much displaced toward the red as to indicate recession at the rate of 29 miles a second. The inquiry was resumed by Huggins with improved apparatus in the following year, when the velocities of thirty stars were approximately determined. The scope of Sir William Huggins's achievement was not, however, to detect the motion in the line of sight so much as to establish the method of procuring data. His success has been of incalculable value, so much so, that the spectroscopic investigations of stellar movements may confidently be expected to play a leading part in the unraveling of the vast and complex relations which even now we dimly detect among the stars.

The first successful application of the spectroscope to comets was made by Donati in 1864. Comets had previously been considered to shine mainly, if not wholly, by reflected sunlight. They were now perceived to be self-luminous and to be formed, to a large extent, of glowing gas. The next step was to determine the nature of this gas, a problem first attacked by Sir William Huggins in 1868. Winnecke's comet (comet II, 1868) was the subject of his experiment. He first revealed the typical hydro-carbon spectrum with which we are now familiar. Tebbutt's comet (comet III, 1881) was the first comet of which the spectrum was photographically recorded, a feat in which Huggins was completely successful. That achievement threw open to investigation a part of the cometary spectrum invisible to the eye, so as to afford an additional test of cometary constitution.

In the field of stellar spectroscopy Huggins's work is assuredly monumental. Almost simultaneously, in 1862, this novel line of investigation was entered upon by Huggins in London, by Father Secchi in Rome, and by Lewis M. Rutherfurd in New York. Hence Huggins may well be considered as one of the fathers of stellar spectroscopy. When he brought to a successful culmination his early experiments in spectroscopic photography, we really began to learn something of the composition of the fixed stars. On December 18th, 1879, he was able to communicate to the Royal Society results answering to his expectations.

The dry-plate process, with which such wonderful results have been obtained in astronomical photography, *appears to have been first* made available by Sir William Huggins in photographing the spectrum of Vega in 1866. That work laid the foundation for the brilliant application of photography to astronomy by Common, Draper, Janssen, Rutherfurd, and later astronomers.

A fairly complete preliminary answer to the question, 'What are the stars made of?" was given by Sir William Huggins in 1864. By laboriously comparing stellar dark lines and the bright rays emitted by terrestrial substances, he sought to verify his conclusions regardless of cost in time and trouble. Although he himself averred that the full investigation of a single star spectrum would be the work of years, he was able to furnish however detailed and accurate drawings of the spectra of Betelgeux and Aldebaran.

Before Huggins applied the spectroscope to the study of nebulæ, it was felt that these mysterious, filmy objects of light would forever thwart the astronomer. Each new and more powerful telescope that made its appearance had resolved into clusters stars which previously had appeared to the naked eye as single orbs. It was felt that those filmy stars which had resisted all attempts at telescopic resolution might be similar clusters, for which reason some doubt was cast upon Herschel's theory that they were masses of shining fluid."

On August 29th, 1864, Sir William Huggins sifted through his prisms the rays of a bright planetary nebula in Draco. To his infinite surprise, they proved to be of one color mainly and thereby proclaimed their gaseous nature. Thus Herschel's conjecture of a "shining fluid' diffused at large throughout the cosmos was unexpectedly verified. By 1868 Huggins had separately examined the spectra of about seventy nebulæ, of which one-third displayed gaseous characteristics. All of these gave the green ray fundamental to the nebular spectrum and emanating from an unknown form of matter named by Huggins "nebulum." A successful beginning in nebular spectrography was made by Sir William Huggins on March 7th, 1882. Five lines in all stamped themselves upon a plate, exposed to the rays of the nebula in Orion.' Thus was photography definitely made the scribe of the nebulæ.

The effect of Huggins's work has been to remove the astronomer from the eye-piece of the telescope, to substitute for the retina the more sensitive photographic plate, and to teach the astronomer the immeasurable value of the spectroscope in analyzing the composition of stars which in the telescope appear as mere points of light pricked in a sable canopy. Huggins introduced physical methods into astronomy and transformed the observatory into a laboratory.

AERONAUTICS.

On May [illegible] M. [illegible] flew from Mourmelon to Chalons, France, a distance of about 20 miles across country. The flight was made in a biplane at a claimed speed of 46½ miles an hour.

Daniel Kinet, a Belgian, flew 2 hours and 51 minutes with a passenger in France on the 15th instant. This flight was also made in a biplane and constitutes a new world's record.

Mr. Clifford B. Harmon has been making some excellent flights of nearly a half hour's duration at Mineola, L. I., in the Farman biplane which he purchased from Paulhan. On the 31st he gained the pilot-aviator license of the Aero Club of America by making [illegible]-mile flight. He is the first amateur sportsman in America to take up aviation, and is doing a great deal for the cause.

Mr. Moore, of Washington, D. C., who has been Mr Emile Berliner's assistant for some time past, has constructed a very light monoplane, fitted with a 35-horse-power revolving-cylinder motor. The machine and motor complete weigh but 260 pounds. The motor is placed above and between the wings at the front end of the machine. The cylinders revolve in a horizontal plane, and drive the propeller through bevel gears. Mr. Moore has gotten off the ground a number of times with his monoplane and made several successful short flights.

On May 18th, the day when the tail of Halley's comet was expected to sweep over the earth, Prof. A. Lawrence Rotch sent up a series of sounding balloons from his Blue Hill Observatory These balloons were equipped with meteorographs and with apparatus for obtaining samples of the air at high altitudes. Prof. Rotch's observations were made simultaneously with those of thirty other experiment stations scattered throughout Europe. Some members of the U S Geological Survey also attempted to catch particles of cometary dust at the Carnegie Observatory on Mount Wilson, California, by placing on a high tower a plate coated with glycerine Several balloon parties were organized throughout the country to view the comet when it was nearest to us.

Another new monoplane that has flown successfully is that of Mr. Gardner Hubbard, which was built by Messrs. McCurdy and Baldwin at Baddeck, Canada This machine is a cross between the Blériot and Antionette types. It has 260 square feet of supporting surface, the overall length being 34 feet and the spread of the wings 30 feet 2 inches It weighs complete about 1,000 pounds without the aviator, a 40-horse-power, six-cylinder water-cooled motor of 320 pounds weight furnishing the motive power The propeller is driven by sprockets and chain, with a gear reduction of three to five. On April 5th, nine flights were made above the ice on Lake Bras d'Or, by Mr. Hubbard, who had never flown before. The monoplane reached an elevation of about ten feet, and flew several hundred feet each time

In a recent aeronautic note we mentioned an aeroplane flight of five minutes duration with four passengers. As a matter of fact M Roger Sommer took but three passengers with him on his record breaking flight of April 20th. These were Mlle Dutrieux (45 kilogrammes, 99 pounds) and MM Colombo (60 kilogrammes, 132 pounds) and Frey (58 kilogrammes, 128 pounds) Sommer himself weighs 151 pounds. The total live load was 510 pounds, and the weight of the biplane complete was 550 pounds, making a total weight of 1,060 pounds that the 50-horse-power Gnome motor raised in the air in 30 seconds. The weight-lifting efficiency of Sommer's machine is therefore 92 per cent. The previous record of this kind was made by Henry Farman with a similar machine when he covered 10 kilometers in 10½ minutes with two passengers weighing 110 kilogrammes plus 30 kilogrammes of ballast.

On the 9th instant Messrs. A. H. Forbes and J C. Yates made an ascension at Quincy Ill., in the former's new balloon "Viking," one of the largest and most up-to-date aerostats thus far constructed. The aeronauts hoped to make new distance and endurance records, but in this they were disappointed They claim, however, that their balloon reached a height of 20,000 feet nearly 24 hours after they ascended. Because of the great height attained, a considerable amount of gas was lost, and when the balloon descended it was in a flabby condition. As a result of this the concentrating ring settled and pulled the rip cord (which was attached to it), ripping open the balloon when it was [illegible] feet above ground. It dropped suddenly without any retardation, as the envelope failed to form a parachute. The basket struck the ground squarely and the aeronauts were rendered unconscious. Fortunately they escaped without serious injuries owing to the cushioning effect of a pneumatic mattress which they had in the car.

ELECTRICITY.

By using a stethoscope and a sensitive telephone relay, the heart beats of a patient in London were transmitted to the home of John Milne, the noted seismologist, on the Isle of Wight. The heart throbs were heard by four physicians over an ordinary telephone, and so clear, was the transmission that it was possible to diagnose the heart troubles It is expected that this use of the stethoscope with a telephone relay will enable physicians to keep in better touch with their patients.

An electrical thermometer which is very sensitive to slight fluctuations of temperature, has recently been put out by a German company for medical use, to determine the degrees of fever It consists of a coil of platinum wire inclosed in a quartz glass tube, through which a current is passed from a four-volt storage battery The tube is placed in the armpit of the patient, and a milli voltmeter indicates variations in the resistance of the coil, due to the heat of the body The milli-voltmeter traces a temperature curve on a band of paper, and in this way it is possible to study the action of drugs on the patient.

According to a recent press report, steamships of the French trans-Atlantic line are using the apparatus invented by Signors Bellini and Tosi of the Italian navy, by which wireless messages may be transmitted in and received from, any desired direction The particular advantage of this apparatus on shipboard is the fact that it enables the operator to determine from what direction a signal is coming, and the course of the vessel can be governed accordingly. Recently the "Provence" crossed the Atlantic, equipped with this apparatus, and was able to determine the positions of various vessels passing in the vicinity The danger of collision was thus entirely obviated

An interesting paper on insulating materials for wireless telegraphy was read recently before a meeting of the Wireless Institute in this city by Mr Stanley M. Hills. He pointed out that rubber is not permanent, but apt to deteriorate, that marble is hydroscopic and not to be relied upon because of its irregular composition, that porcelain is apt to contain hidden defects, and that glass, while the defects it contains may be detected visually and thus avoided, is extremely fragile He spoke of mica and of wood as good insulators if kept dry, and dry oil is a good insulator for the reason that it is liquid and "self-healing" Dry air makes an excellent insulator, and for high voltages, compressed air may be used

The advantages of an electrical shovel over a steam shovel have recently been portrayed, showing that wherever electricity is available at moderate rates, the electric shovel is much to be preferred One of the great objections to the steam shovel is the fact that the expenses of a fireman must be paid, and the fuel, as well as the water, have frequently to be carted for a very long distance. Steam must be kept up continuously, despite all delays in operating the shovel, while for the electric shovel the same arguments apply as are made in behalf of electric drive in machine shops, namely, that when the shovel is idle there is no consumption of power, yet the power is ready for instant use whenever it is needed

An interesting discussion by Dr Charles P Steinmetz on the magnetic properties of materials was published in a recent number of the Electrical World It was stated some years ago that magnetic alloys could be made by combining non-magnetic materials Dr Steinmetz points to the fact that in all the Heusler alloys manganese is used, and that this is slightly ferro-magnetic One of the simplest of these alloys consists in combining one part of manganese with three parts of antimony, the mixture being made by powdering the metals and then heating them in a test tube. The result is a black powder which is strongly magnetic, Dr Steinmetz states that no magnetic alloy has been found which does not contain some of the ferro-magnetic group—iron, cobalt, nickel, manganese, and chromium

Now that air craft have been entered as war vessels, inventors are beginning to cast about for some effective means of destroying them. Recently an aerial torpedo has been invented, which, by means of a Hertzian wave controlling system, may be directed from a distance without carrying any operator. This torpedo was exhibited at the London Hippodrome, where the inventor caused it to travel out over the audience, steering it wherever he chose by pressing buttons on a switchboard on the stage The torpedo is provided with two screws, which may be operated independently to steer the ship laterally, while a horizontal rudder serves to steer the vessel vertically. The device may also be equipped with explosives, to be dropped on the enemy when the torpedo has been maneuvered to the right position This was demonstrated at the Hippodrome by releasing flowers on the audience.

SCIENCE.

Edward B. Garriott, chief forecaster of the United States Weather Bureau, died recently at Washington at the age of 57 He had been connected with the Weather Bureau practically since its establishment, which means for forty years

After thirty months' cruising in Philippine waters, the Fish and Game Commission's steamer Albatross," Commander C M McCormick, United States Navy, entered the Golden Gate, San Francisco and dropped anchor The "Albatross" has been engaged in a thorough examination of the fish in Philippine waters

When one solid body glides over the surface of another, the coefficient of friction diminishes as the velocity increases and nearly vanishes when the velocity attains a certain critical value This diminution of friction is due to the air which partially separates the two bodies at low relative velocities and separates them completely at the critical and all higher velocities.

Dr Douglas Mawson, who accompanied Sir Ernest Shackleton on his last Antarctic expedition, arrived recently in this country, bound for Sydney New South Wales, to resume his duties as lecturer on geology in Sydney University Dr Mawson reiterated the statements already made by Sir Ernest Shackleton that there is an immense stream of coal within 300 miles from the South Pole

An interesting method for measuring the transparency of developed photographic plates has been devised by Dr L. H Friedburg A polarized light apparatus is employed An opaque plate not rotating the plane of polarization, when interposed between two parallel mounted tourmaline plates cut parallel to their optical axes, will reduce the angle of 90 deg between extreme brightness and maximum darkness by an amount proportional to the density of the silver deposit.

The emission spectra produced by certain elements heated in quartz tubes to 2 500 deg F have recently been studied It is found that in these circumstances sulphur produces a blue light and a nearly continuous spectrum Selenium gives a pale yellow light with bands, which are generally well defined, but become uncertain toward the red end Tellurium emits a green light and its spectrum contains numerous bands which are also hazy toward the red end Phosphorus and arsenic give a white light and continuous spectra, while antimony produces a nearly continuous spectrum, crossed by very ill-defined bands

The distinguished German chemist Ostwald has taken out a German patent for the improvement of drawing inks and water colors He has found that by the addition of small quantities (from 1 100 to 1 1,000) of volatile organic compounds of the aliphatic series, which are soluble in water, at least to a small extent and contain not less than four atoms of carbon inks, drawing inks and other water colors are rendered capable of readily marking such surfaces as parchment ivory, waxed paper etc In the case of neutral liquids, an alcohol, ester, or other neutral substance is used, while to acid inks, free fatty acids, such as valeric or caproic acid may be added

How bright is the sun? No two authorities agree Another estimate has recently been made by C Nordmann The effective temperature determined with his pyrometer was found to be about 5 320 deg absolute Now, the brightness of an incandescent body emitting white light varies sensibly as a function of the temperature, and this law has been verified by comparison with numerous terrestrial light sources. Taking into consideration the absorption of the solar atmosphere, the effective temperature of the photosphere is probably about 6,450 deg absolute The corresponding brightness of the mean effective layer is then about 219 000 decimal candles per square centimeter The solar surface is thus considered to behave very like a black body, and to have an emissive power of nearly unity

Ducelliez has made a study of the chemical character of various alloys of cobalt with tin, antimony bismuth, lead, and copper, by measuring the difference of potential between each alloy and each of its constituents, when immersed in a solution of cobalt sulphate The results are expressed in graphical form The curve of the cobalt-tin alloys shows a distinct inflection at the percentage of 66 76 of tin, which corresponds to the compound CoSn The cobalt-antimony curve indicates the existence of two definite compounds, CoSb and $CoSb_2$. The cobalt bismuth alloys also show two distinct compounds The electromotive force produced by most of these alloys is very small The curves show that in the separation of the two metals by the process of solution, the cobalt remains undissolved in practically pure condition, while the solution of bismuth contains about 5 per cent of cobalt. The behavior of the cobalt lead alloys is similar to that of the alloys of cobalt and bismuth.

THE LATEST GIANT FREIGHT ENGINE

FOR USE ON THE HEAVY GRADES OF THE DELAWARE & HUDSON RAILROAD

It takes but a glance at these photographs of the huge Delaware & Hudson freight engine recently turned out from the shops of the American Locomotive Company to realize to what Brobdingnagian proportions the freight engine has grown. The two men inside the 41-inch low-pressure cylinders, one of them comfortably seated, the stalwart mechanic standing erect in the 90-inch front end of the boiler with a foot and a half clearance between his head and the roof, tell their own story of dimensions. To this may be added the following particulars. There are, as usual in the articulated type, two engines on two trucks, the forward a low pressure with cylinders 41 inches diameter by 28 inches stroke, the after engine a high pressure with cylinders 26 inches diameter by 28 inches stroke. Each engine drives eight, coupled, 51-inch driving wheels which carry the whole weight, 445,000 pounds, of the engine. The tractive power working compound is 105,000 pounds, and the calculated horse-power under ordinary working is over 2,600.

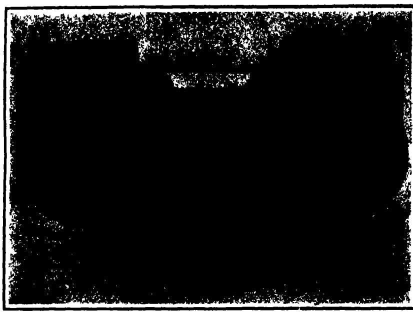
The huge boiler, 90 inches diameter at its smallest ring, has a total heating surface of 6,629 square feet, and it supplies steam at 220 pounds pressure.

The tender carries 9,000 gallons of water and 14 tons of coal; its weight loaded is 166,800 pounds, and the engine and tender together weigh 611,800 pounds.

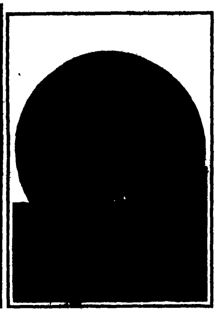
The engine can haul on the level at 10 miles per hour 100 fifty-ton cars, each of which loaded will weigh 72 tons. This will mean a load behind the tender of 7,200 tons, or a total load for the train of over 7,500 tons.

The company has built six of these engines for the Delaware & Hudson Company. They are designed for pusher service on the Wilkes-barre & Susquehanna division of that road, between Carbondale, Pa., and Oneonta, N. Y.—a distance of 95

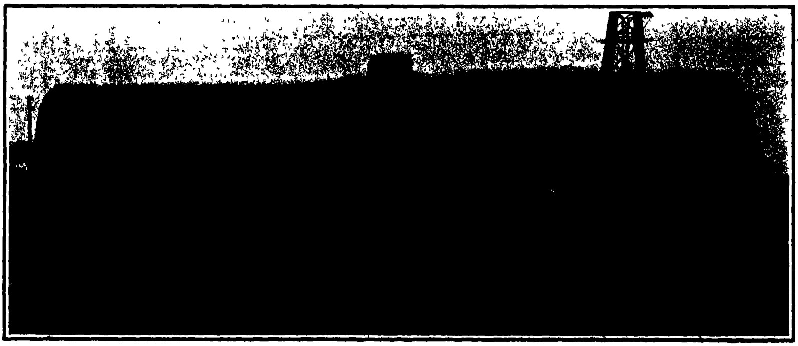
(Concluded on page 449.)



A man can be comfortably seated in each of the 41-inch low-pressure cylinders.

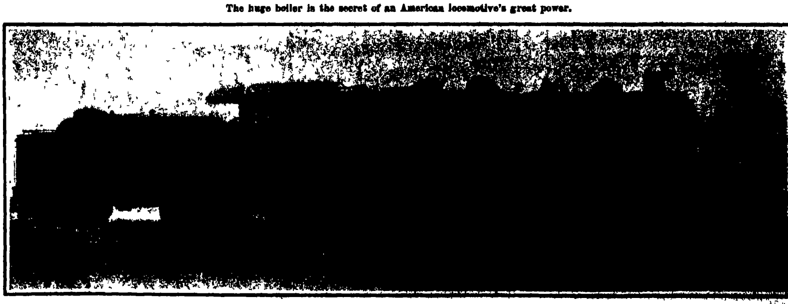


Front end of boiler is 7½ feet diameter.



Largest diameter, 96 inches. Length, 44 feet 10 inches. Weight with water, 60 tons. Firebox, 10 feet 6 inches by 9 feet 8 inches—would make a fair living room.

The huge boiler is the secret of an American locomotive's great power.



Weight, engine and tender, 611,800 pounds. Weight on drivers, 445,000 pounds. Cylinders: High-pressure, 26 inches by 28 inches; low-pressure, 41 inches by [illegible] inches. Tractive power: Compound, 105,000 pounds, simple, [illegible] pounds. Boiler pressure, 220 pounds. Heating surface, [illegible] square feet.

THE LATEST OF THE HUGE ARTICULATED FREIGHT ENGINES.

Eiffel's Recent Experiments on the Resistance of the Air

BY JACQUES BOYER

Eiffel's first experiments on the resistance of the air, a problem which is now engaging the attention of many scientists because of its importance in aeronautics, were made in 1907-8 at the famous Eiffel Tower, which was constructed for the Paris Exposition of 1889. The surface on which the pressure of the air was to be studied was allowed to fall from the platform of the second story of the tower, in connection with a chronographic apparatus, which recorded the resistance opposed by the air at each instant. The surface was carried downward by a heavy and dense mass, offering little resistance to the air. This mass was placed above the surface, with which it was connected by springs, which were compressed more or less, according to the air resistance. The velocity of fall ranged from 50 to 130 feet per second. The apparatus was guided in its fall by a vertical cable, and was prevented from striking the ground by a progressive enlargement of this cable beginning at the height of about 70 feet from the ground. In this way the falling body was gradually brought to rest by the action of spring brakes. A tuning fork, making 100 vibrations per second, was attached to the surface. To one of the prongs of this tuning fork was attached a style, which as the fork vibrated, moved vertically over the surface of a vertical cylinder, which was covered with paper coated with lampblack, and was caused to revolve with a speed proportional to the velocity of fall. Hence the record takes the form of a fine sinusoid, the median line or axis of which forms an irregular line around the cylinder. Each point of this axis corresponds to a certain position of the falling body. The number of undulations between this point and the beginning of the trace, gives the time; the ordinate of the point indicates the tension of the springs, and consequently the pressure of the air on the surface, at that instant; and the abcissa is proportional to the distance through which the body has fallen. Hence the trace gives the position and velocity of the body and the resistance opposed to its motion by the air at every instant. Eiffel experimented in this way with plane surfaces of various forms, square, oblong, circular, continuous, and cut or perforated, with groups of superposed plane surfaces, and even with spherical and conical surfaces. He arrived at the following conclusions. For velocities between 60 and 130 feet per second, the resistance of the air is very approximately proportional to the square of the velocity. The exponent of the velocity differs very slightly from 2 and appears to increase regularly with the velocity, passing through the value 2, at the velocity of 110 feet per second. The pressure per square inch was furthermore found to increase with the area of the surface.

The influence exerted by superposed surfaces on each other is very great. In some cases the resistance is smaller for a group of surfaces than for a single surface. For surfaces inclined to the direction of the wind, Eiffel formulated in 1908 the following law. For inclinations to the horizon varying between 0 and 30 degrees, the pressure is proportional to the angle, while for inclinations greater than 30 degrees, the resistance is constant.

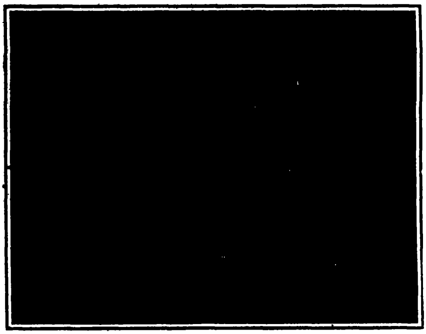


Fig. 9.—The Eiffel aerodynamic balance placed above the experiment room.

In order to extend these observations (which have been fully described in the SCIENTIFIC AMERICAN) Eiffel constructed in 1909 an aerodynamic laboratory at the Champ de Mars, Paris, where he has subsequently conducted experiments with fixed surfaces, exposed to air currents produced by a blower of 50 kilowatts power. By this method he was able not only to obtain the resultant pressure, but to determine the distribution of pressure on both sides of the surface and the movement of the air in its vicinity.

In order to place the surface in conditions as nearly as possible identical with those produced by a natural wind or by movement in the open air, the air current must have so large a cross section that its exterior filaments will not be affected by the presence of the surface. The pressures experienced by the surface are measured by an aerodynamic balance, by which it is possible to determine the horizontal and vertical components, as well as the center of pressure, data which are very important in the construction of aeroplanes. The aerodynamic balance is shown in diagram in Figs. 1 and 2. The experimental surface is attached to the rod C, which is placed parallel to the air current. This rod is attached to a rigid T-shaped frame DE, which is capable of motion around a knife edge A. The action of the air current is opposed by an upward pull at f produced by the weight P, in the balance above. When equilibrium is established the moment of the forces which tend to move the experimental surface and its support round the knife edge A, can be computed from the weight in the scale pan. Two weighings are made, when the air is at rest and when it is in motion at known velocity. The moment produced by the air current is the difference of the two results. The other end of the rod E carries a second knife edge B, which is directed upward and which can be brought to bear against its seat by shortening the rod H, by means of the eccentric G. In this way the moment of the air pressure around B can be measured. Thus it is possible to measure the moments of the pressure with respect to two points, furthermore, as the rod C can be rotated about its axis, the elements of the resultant pressure upon an inclined surface can be determined by making four measurements, at azimuths differing by a right angle. The vertical part D is a rod of cast steel, which is capable of slight motion in a sheath attached to the floor of the room above, on which the balance stands. This sheath which is very narrow and is beveled in front and behind, protects the vertical rod from the air current, without appreciably affecting the latter. The horizontal part F is provided with a pair of knife edges at each end. The knife edges at the front or windward end A are directed downward and backward, while those of the other end B are directed upward and backward. The seats of these knife edges have projections, which prevent the knife edges from moving along the grooves in which they turn. By moving a lever, the knife edges in front can be lifted from their seats to protect them from wear, except during the actual experiment. The rod H, which connects the frame E with the beam of the balance, touches these parts only by means of knife edges. In short all the moving parts of the apparatus turn on knife edges, and the friction is negligible. The T-shaped piece DE weighs more than 100 pounds. This great weight is not an inconvenience but serves two useful purposes, by lessening and damping the secondary oscillations, due to small variations in the force of the air currents and by making the equilibrium of the balance stable in every relative position of the current and the surface. The entire apparatus is supported by a massive wooden platform, about 8 feet square, which rests on a double layer of sleepers, buried 10 feet below the floor of the room and lying parallel with the direction of the air current.

The current of air is drawn through a tube 6½ feet in diameter, and every precaution is taken to keep its strength uniform during the experiment. The air is drawn from a large closed room in which the surface

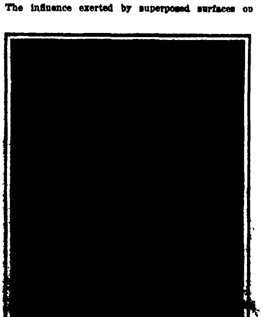


Fig. 6.—Experiment room of Eiffel's aerodynamic laboratory.

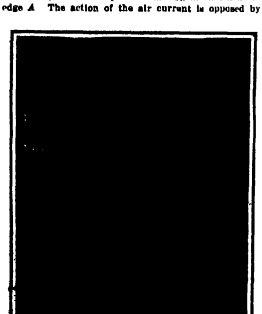


Fig. 7.—The inlet of the blower.

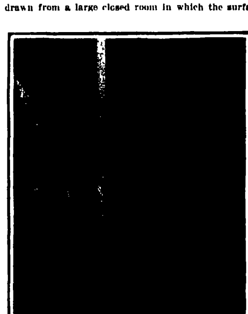


Fig. 8.—Arrangement of apparatus for measuring pressures at various points of the surface.

EIFFEL'S RECENT EXPERIMENTS ON THE RESISTANCE OF THE AIR.

is placed near the inlet of the blower, and not at its outlet, as is usually done The air which leaves a blower is subjected to irregular disturbances, which cannot be overcome sufficiently to produce uniform and constant velocity over the entire surface The pressure exerted upon the surface is transmitted to the balance in the room above, where the observer is stationed The air enters the experiment room through a cellular diaphragm in parallel filaments At the opposite end of the room is the mouth of the conduit which leads to the blower and which contains two iron-wire gratings of 2/5 inch mesh, placed about 40 inches apart which almost completely eliminate all irregularities of flow The air leaves the blower through a conduit which gradually enlarges and serves still further to assure regularity of flow Hence, the velocity and direction of the air current are uniform through out its whole section and, as the apparatus is entirely inc'osed, it is not affected by the wind outside

The velocities of the air current are deduced from the readings of manometers, and the results have been verified in the following manner One of the sur faces exposed to the current was perforated with a large number of holes, in each of which was countersunk a screw, having at its center an orifice 1/50 inch in diameter By measuring with a small manometer the pressure produced behind each of these orifices, and integrating the result, the same resultant force that had been indicated by the balance was obtained

We cannot here relate in detail all the interest ing results which Eiffel and his assistant Léon Rith have already obtained in this laboratory We will mention only a few of the more important conclusions

Eiffel has proved that the value of the horizon tal component, or resistance to the advance of an aeroplane, increases continually with the inclina tion of the surface to the horizon, while the vertical component attains a maximum at an inclination of 15 degrees, and thereafter diminishes very rapidly, and vanishes at 90 degrees, i e, when the plane is vertical

The surfaces employed in these experiments had a plane of symmetry parallel to the wind In order to determine the direc tions of the air filaments in this plane, a short and very light wire, attached to the end of a thin rod, was placed at various points of the plane, and the position and direction of the wire were deter mined as accurately as possible In most cases it was found that especially near the front edge of the surface, the direction of the wire fluctuated rapidly between two fixed limits This fluctuation in the direction of the wire is due to the fact that at any instant the air flows according to a definite, but not very stable, system so that only a very small influence is required to pass from one system to another The various possible systems of flow could be approximately determined by careful observation and comparison of the directions of the wire

Fig 3 shows the directions of the air filaments near a square surface, the plane of which makes an angle of 40 degrees with the direction of the current Fig. 4 shows the directions of the stream lines near a surface inclined 80 degrees to the current. It will be observed that these lines are very variable and consequently very instable The same fact is shown when the surface is perpendicular to the current. Fig 5 shows the average direction of the air at various points in this case In the two regions inclosed by the dotted lines, the disturbance is so great that no mean direction of flow could be determined

In regard to the center of pressure, this coincides with the center of figures if the surface is horizontal, gradually moves forward as the inclination increases to 15 degrees, and thence recedes as the inclination is increased, and again attains the center of figure when the surface becomes perpendicular to the current. Finally, Eiffel indorses the almost universal preference of aviators for curved sustaining surfaces, and proves that, for a given resistance to forward movement, the curved surface always develops a greater lifting power than the plane surface, especially at small inclinations.

The Transit of Halley's Comet.

The transit of Halley's comet and the expected immersion of the earth in the tail of that historic body have proven once more what may happen to the best-laid plans of mathematicians. The transit undoubtedly occurred, but whether or not the earth really encountered the tail seems to be a matter of considerable doubt. When the night of May 18th came, and the scientific world was all agog, the tail was so curved that the passage of the earth through it seemed only remotely possible On the morning of the 20th a broad band of light that stretched along the horizon for a distance varying from 120 to 160 degrees proclaimed indubitably that the earth was still untouched, and that contrary to expectations, the comet was still in the east Prof W W Campbell, of the Lick Observatory, saw the comet visibly in the eastern sky According to him, the tail was at least 140 degrees long and lagged far behind the radius vector Because of the angle of 18-odd degrees which separates the earth's orbit from that of the comet, the curvature of the tail, to which this extraordinary misadventure may probably be traced, probably prevented the earth from coming in contact with it.

All the scientific expeditions which have been sent out to various parts of the earth will probably come back with nothing to report. Some of these scientific parties must have proceeded to their destinations at considerable expense Thus Prof Birkeland, of the University of Christiania, went to Kaafjord, in the northern part of Norway, for the purpose of noting whatever electrical and magnetic effects might be attributed to the comet's tail, and particularly to observe the relation of the aurora borealis to the comet. He has his own theory that the particles of a comet's tail are so highly electrified that they may, in some way, affect the aurora borealis. The failure of the expedition, which it is almost safe to assert, still leaves that theory unproved.

Similarly unsuccessful must be all the elaborate preparations made by meteorologists, navigators and physicists. The more important meteorological stations of the world sent up sounding balloons at frequent intervals on the 18th and 19th of May, for the express purpose of bringing down from the upper strata of the atmosphere some record of unusual happenings which might safely be attributed to the influence of the comet. All this labor is now in vain. Similarly, it is very unlikely that the instructions sent forth by the United States Hydrographic Office to wireless operators, charging them to note any curious and unusual effects on their instruments, will prove barren.

The expedition which was sent to the Hawaiian Islands by the Astronomical and Astrophysical Society of America for the purpose of observing the transit cables a preliminary report of complete inability to note any transit whatever. This was more or less expected In 1882 a transit occurred which was fortunately observed by Mr Finlay at the Cape of Good Hope. The comet of 1882 was followed by him "continuously right into the boiling of the limb." No sooner had it touched it, than it vanished as if destroyed So sudden was the disappearance, that the comet was at first believed to have passed behind the sun As a matter of fact, the observers at the Cape had witnessed a genuine transit The experience of the observers at the Hawaiian Islands with Halley's comet seems to have been exactly similar On the whole, this apparent failure to observe the creeping of a black speck across the face of the sun may be deemed a confirmation of our present theories that the bulk of a comet is much too flimsy to be detected in the blinding glare of our central luminary

Although the passage of the earth through the tail of Halley's comet turned out to be an extraordinary disappointment, it is unfair to charge our mathematical astronomers with incompetence A comet's tail is so capricious, so fluctuating a structure, it changes with such startling rapidity, that the predictions of any astronomer with regard to its behavior must always be stated with some reserve.

The tail of Halley's comet has conducted itself in a most whimsical fashion In the middle of February, it was some fifteen million miles long. In April, it seemed to have vanished entirely. Then it grew again, until finally it attained a length that has been variously placed at twenty to forty million miles. It seems to have split longitudinally into three more or less well defined parts. When we consider that Morehouse's comet of 1908 (comet C, 1908) exhibited some extraordinary changes; that it repeatedly formed tails, which were discarded to drift out bodily into space, until they finally melted away; that in several cases tails were twisted or corkscrew shaped, as if they had gone out in a more or less spiral form; that areas of material connected with the tail would become visible at some distance from the head, where apparently no supply had reached it from the nucleus; that several times the matter of the tail was accelerated perpendicularly to its length; and that at one time the entire tail was thrown forward and violently curved perpendicularly to the radius vector in the general direction of the tail's sweep through space (a peculiarity opposed to the laws of gravitation), it is evident that a comet presents important problems for the future astronomer to solve. It is no wonder that Halley's comet should have distinguished itself.

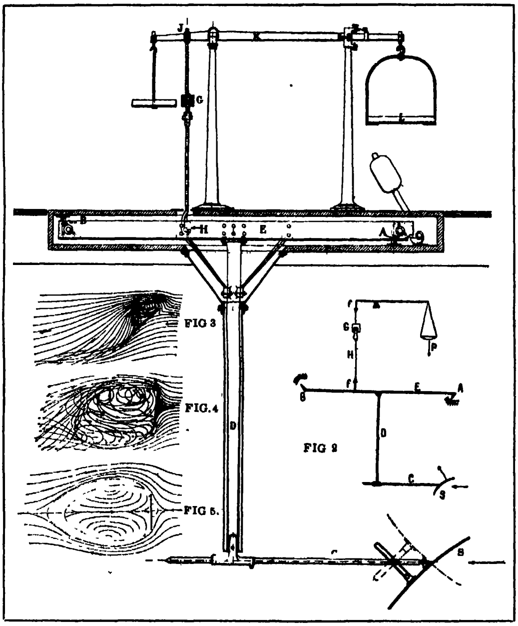


Fig 1 The Eiffel aerodynamic balance. Fig 2. Diagram of the balance. Fig. 3. Direction of stream lines near a square plate inclined 40° to the air current Fig 4 Stream lines near a square plate inclined 80° to the air current. Fig 5. Stream lines near a square plate perpendicular to the air current.

Correspondence.

MEASURING AEROPLANE HEIGHTS.

To the Editor of the SCIENTIFIC AMERICAN

Replying to your communication of recent date, requesting me to forward a drawing of an apparatus which some French journal has stated I have for ascertaining the height of an aeroplane in flight, I beg leave to say that there is some inaccuracy in the statement as quoted.

Primarily, the apparatus used were merely a roughly-made "range rake," such as has been in use for some time in the Coast Artillery Corps for computing the "overs and shorts" that occur during their big-gun practice. Secondarily, in so far as accuracy is concerned, it cannot by any imagining be considered as accurate as a triangulation method employing two transits with a long connecting base line.

The "range rake" is simply a wand about three feet in length, having at one end a set of fine saw-teeth placed at right angles to the wand on a metal strip several inches in length Measurements are taken between teeth to the right and left of the middle tooth.

The principle on which this depends is that of similar triangles, the same being illustrated by the accompanying diagram. From this diagram and description it can readily be seen that the short base line precludes any great accuracy in the computations.

However, to apply the facts to the particular flight

MEASURING ALTITUDE OF AEROPLANE WITH A RANGE RAKE.

B C : A D : : ef : A x ; ef = width of aeroplane, B C apparent width measured on the rake.

which was referred to in the French journal, I am of opinion, personally, that Paulhan actually attained an elevation of approximately forty-six hundred feet, for the following reasons.

1 The official figures were taken by two transits set one thousand feet apart. The solution of the obtained triangles gave him an altitude of 4,165 feet. The method and computations of the triangles were undoubtedly correct. The error, if any, was due to the fact that he attained his maximum height when crossing the line joining the transits. This so appeared to me At that time, owing to the acuteness of the angle of elevation, it was impossible for either transit to take a reading, both being interfered with by the horizontal bases of the instruments. The maximum height as taken by these transits was when Paul han was distant from the base line approximately one mile.

2 Paulhan had with him an aneroid barometer, corrected but not sealed. He stated that this registered a maximum of 4,600 feet (after being reduced from meters).

3 The maximum height as taken by Capt Samuel Bottoms, Coast Artillery Corps, U S A., and myself with a "range rake" was 5,287 feet.

From all of the above I am of the opinion given above, viz., that Louis Paulhan actually attained a height of approximately four thousand six hundred feet at the Los Angeles meet, but am also of opinion that the official figure of 4,165 feet was the only one which could have been accepted under the circumstances,

PAUL W. BECK,

First Lieutenant Signal Corps, United States Army.
Presidio of San Francisco, Cal.

The output of the Clyde shipbuilding yards during April totaled 19 vessels and 60,000 tons, which is the largest recorded since July, 1907, when the output totaled 67,000 tons. The aggregate for the four months amounts to 154,000 tons, as compared with 72,000 tons in the corresponding period of last year. The total included a battleship. A fair amount of new work has been booked during the month, and prospects are good.

HOW CHICAGO IS SOLVING ITS RAPID TRANSIT PROBLEM.

BY D. H. STEVENS.

The city of Chicago has been hard at work rehabilitating its surface street-car systems, and completing plans for the new subway lines. The engineers of the city have estimated how many passengers enter and leave Chicago's six square miles of business area every twenty-four hours, and the results prove that the present lines are hopelessly overworked During two normal business days of the past year it was found that on all of the lines running into the down town district bounded by Chicago Avenue on the north, by Twelfth Street on the south, on the west by Halsted Street, and on the east by Lake Michigan, an area of about six square miles, every seventh passenger was without a seat. When it is remembered that the service cannot be improved much along present lines, it is clearly seen that a subway is imperative At a conservative estimate, the next generation will see a demand for train facilities from the central district of the city equal to all facilities now available from the central part of New York city, with all its ferries, tunnels, subways, bridge and surface lines. To meet this need, the engineers have planned a system which it is believed will adequately meet this great demand for cars during the rush hours

The complete system will be bounded on the north by Chicago Avenue, on the south by Twenty-second Street, on the west by Halsted Street, and on the east by Wabash Avenue Four terminal stations will be built immediately at the boundaries of this subway zone, one at Chicago Avenue and North Franklin Street, one at Dearborn and Twenty-second Streets, another at Van Buren and Halsted Streets, and the fourth at Randolph and Halsted Streets The new underground will begin where the four elevated lines now enter the district, and all surface cars from the respective quarters of the city will also converge at these four terminal stations, where all surface and elevated cars from the resident districts will become subway cars, and will remain under the surface until they again pass out of the district.

As shown in the front page plan, a four-track route will run close to the surface of Wabash Avenue from Chicago Avenue to Twenty-second Street This route will carry all through cars from the South and North Sides, two tracks being exclusively for surface cars and two for elevated trains. After passing to the opposite limit of the district, the trains from each direction will turn about and will return to their respective starting points by the same route

From the West Side of the city two tubes will run in beneath Randolph and Washington Streets as shown in the accompanying plan, and will turn southward on State Street, and then return to the West Side under Adams Street and Jackson Boulevard After coming out into daylight at the Halsted Street terminal, these cars will also scatter to all points on the west side of the river

To complete this first stage of plan one will cost about forty millions of dollars. Its capacity will be fifty per cent greater than that of all the traction lines now operating within the district With the aid of surface cars to make short hauls within the business district, this plan will serve the needs of the city for many years.

An additional expenditure of forty millions will then build the second stage of this plan, when other busy streets will cover branches of the system In this stage of the development will be found both loops and through routes for all parts of Chicago Yet where the various tunnels cross one another there will be no grade crossings one tube will dip in its course so as to pass completely under the other line This will eliminate all danger of underground collisions.

A further expenditure of thirty-two million dollars will serve to complete the system, when every street within the subway zone will have beneath it a branch of the subway Two, three, and four-track subway lines will honeycomb the whole area, and the entire district will be served by the most elaborate, yet the most efficient, subway system in the world This plan, in its completed form, will cost about one hundred and twelve millions of dollars, and will serve the needs of the city at its present rate of growth until 1950 Improved methods of transportation will probably cause the business district to expand, and the subway will be built accordingly It may ultimately be possible to remove every yard of rail and every car from the surface of down-town streets.

On our front page is shown a cross-section of one of the future stations on Wabash Avenue. As seen in this picture, the tracks lie close to the street surface Because of the danger to certain building foundations, a low-level subway is impracticable, and the cost would be prohibitive As the entire subway is to lie in the soft blue clay that underlies the business district, a special type of construction will be needed The concrete core of the subway walls must be so constructed as to bear heavy pressure from any side, and the engineers have worked out a type of construction to meet this requirement Stations of this type will be built in the center of every block on Wabash Avenue, and the platforms will be but a short distance below the sidewalk level Underground walks will afford opportunity to cross the streets, or to walk parallel to the car line, past the basement windows of the department stores

The cars will include the most modern improvements, such as side entrances, to permit the rapid handling of passengers, provided with automatic signals to show the motorman when all the doors are closed The use of these cars will greatly reduce the length of stops at stations. The plans also provide for the housing of all underground utilities in suitable chambers Every public service corporation will have its own chamber, as shown on the front-page engraving, in which will be accommodated all of its pipe lines within the subway zone Particular care will be taken to provide for the future water supply, a very vital provision in the consideration of the future needs of the business district These chambers will be easily accessible from the street surface, so that it will be a simple matter to inspect or repair the pipe lines of any company The cost of this gallery construction has been included in the foregoing figures, so that an expenditure of one hundred and twelve millions of dollars will give Chicago a complete traction system, and the best possible provision for her public utilities.

This comprehensive plan is the outcome of several months of investigation by City Engineer John Ericson The result is a scheme of construction that is well adapted to meet the peculiar needs of a city that has its entire business interest within an area of six square miles Whatever slight variations may be made in the plans during the progress of construction the scheme for construction as here described will be the general foundation for whatever subways may be built

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The Current Supplement.

The Garratt flexible railroad locomotive is the subject of the opening article of the current SUPPLEMENT, No 1795 The salient features of the locomotive are its extreme flexibility and adaptability for operation on steep grades and sharp curves The mining of tungsten ore is described by Consular Agent Harry A. McBride, of Bilbao From the beginning, American agriculture has been characterized by its extensiveness rather than its intensiveness Land has been more abundant than labor Prof Homer C Price contributes an article entitled "The Reorganization of American Farming in which he points out that the problem which now confronts the American farmer is to adapt his soil to present conditions. William E Stark presents the first installment of a paper on "Measuring Instruments of Long Ago" "Ilo, a Third Universal Language,' is the title of an article describing a universal tongue which is intended to take the place of Esperanto, on which it is an improvement. Prof Ralph Barton Perry writes on the prophecy of Francis Bacon. A profile puppet-show can be made as described by A Rose Some new electrical and physical apparatus are illustrated Prof E A Minchen reviews some applications of microscopy to practical science and modern knowledge

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The Difference Between a Sanitarium and a Sanatorium

The words "sanitarium" and "sanatorium" are popularly understood to have the same meaning and are generally used interchangeably, when designating (or describing) places of refuge for sick people but there is, in fact, quite a distinction between the meaning of the two words. In answer to a correspondent on this subject the Literary Digest says

"The distinction between these words lies in the fact that they are derived from two different Latin roots. 'Sanatorium' is derived from the late Latin *sanatorius*, meaning *health giving* The term relates specially to 'an institution for treatment of disease or care of invalids, especially an establishment employing natural therapeutic agents or conditions peculiar to the locality, or some specific treatment, or treating particular diseases' On the other hand, 'sanitarium' is derived from the Latin *sanitas* from *sanus* meaning *whole* or *sound* 'Sanitarium' relates more specifically to 'a place where the hygienic conditions are preservative of health, as distinguished from one where therapeutic agencies are employed' Hence it is the province of a 'sanitarium' to preserve health, that of a 'sanatorium' to restore it. Care should be exercised in combining the proper vowels in these two words in order to indicate correctly the derivation"

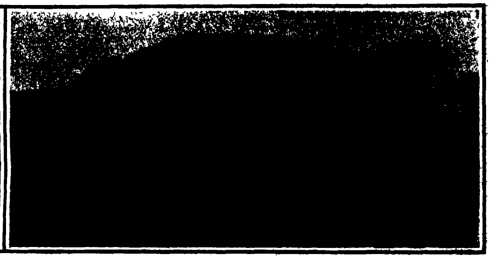
In our issue of May 14th we published an article on the utilization of wireless telegraphy in connection with a Chalmers-Detroit automobile in the Glidden tour Through inadvertence, we neglected to state in the article that the wireless installation was devised by Dr Lee De Forest.

THE CARTAGO EARTHQUAKE.

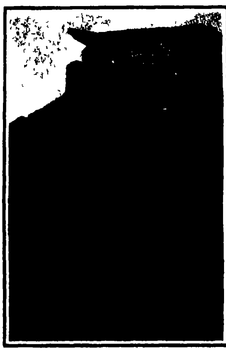
BY PROF. GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

On May 4th, at 6 50 P. M., the city of Cartago, former capital of Costa Rica was wiped out of existence by an explosive earthquake which lasted but a few seconds. The destructive motion was mainly vertical and began suddenly, that is, without the premonitory shocks which usually give most people time enough to run out from their houses. Immediately after the heavy up-and-down motion came a long series of smaller shocks, among which a gyratory motion was perceptible. The dust raised by the instantaneous fall of houses and public buildings was so great that many people thought they had escaped death by crushing only to die of suffocation. Twenty thousand people

A corner of the Palacio de la Paz

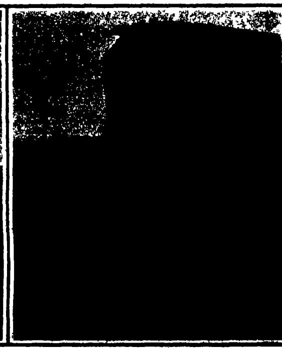


El Palacio de la Paz (Palace of Peace) gift of Carnegie, just completed.



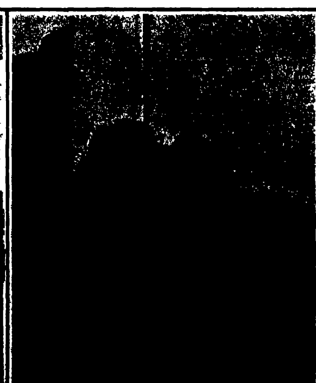
A primary school.

House of Poet Trogo, who was killed on the sidewalk.



Rear view of the wrecked convent.

Front façade of the convent. Note the absolute wrecking of the massive towers.



Top of church tower bodily torn asunder and thrown to the ground.

TERRIFIC RESULTS OF THE "EXPLOSIVE" EARTHQUAKE AT CARTAGO, COSTA RICA.

are left without shelter. As the writer is sending this relation (May 7th) 700 corpses have been dug out of the ruins. That number is rapidly increasing. The number of the wounded is not yet known. They are carried daily, by special trains, to San José. The destitution and suffering are intense. Persons who wish to help may do so through the American legation in San José.

During the year 1909 small earthquakes in Cartago had been rather frequent, and the writer, who had a seismograph in the Cartago College, began to send regular reports to the recently founded Strasburg Central Bureau of the International Association of Seismology. On April 13th, 1910, shortly after midnight, came a first warning of the impending catastrophe, in the form of a series of earthquakes, the third of which fissured many houses, destroyed some poorly built walls, and played great havoc among bottles and earthenware. This earthquake was generally felt on the whole Costa Rican plateau. On the following days smaller shocks, mostly of intensity III to V (Rossi and Forel scale) followed at the rate of some three to eight a day. The population in Cartago and San José became alarmed, and erected in the streets and public parks tents and sheds, in which they slept. The shocks had somewhat decreased in number and intensity when the fatal issue came.

Cartago is situated at an altitude of 4,700 feet, at the very foot of the huge volcano Irazu, which towers 11,500 feet above sea level. The Irazu volcano is considered as extinct, the only remnant of its former activity being a few *fumarolles* or steam jets, located at a considerable distance from the now silent and cold craters. At no time before or after the catastrophe have the fumarolles shown any symptom of increased activity. Moreover, the seismograph in Cartago gave for most earthquakes a direction which was almost perpendicular to that of the volcano. However, a few days before the destructive shock, the direction of the earthquakes became variable, and for some of them coincided with that of the Irazu. On May 4th the needle of the apparatus began writing the last chapter of the drama, and while so doing jumped out several times from the glass plate. Then the seismograph, which is a heavy inverted pendulum contained in a box some three feet high, was violently thrown against the wall; the glass plate fell from its shelf, and was broken in two.

Among the public buildings which are in ruins is the beautiful Palace of Peace, a gift of Mr. Andrew Carnegie. The palace had just been completed, the interior only being left unfinished.

HOW TO ACT IN CASE OF FIRE.

BY PERCY COLLINS.

Perhaps no single ejaculation is capable of producing so instantaneous and so widespread an alarm as the cry of "Fire!" Nor is this surprising when we remember that the fire fiend is each year responsible for an almost incalculable loss, both of life and of property.

Yet of all emergencies, none more than an outbreak of fire imperatively demands a preservation of one's power to act with coolness and decision. Often, by prompt and well-directed action, the threatened catastrophe may be averted, the loss of property and what is still more important, the loss of human life, may be avoided.

Fire drill nowadays has its place in the routine of every well-conducted scholastic establishment, nor can it be doubted that the capacity for prompt and intelligent action thus inculcated in the minds of young people of both sexes has, in emergency, proved the means of preventing appalling disaster. But while this capacity for combined action is very desirable, there seems to be a danger of fostering it at the expense of what one may term "fire education." Every child should be taught by means of precept and experiment, what to do when a fire breaks out in his own house. He should be instructed how to go to work coolly and methodically either to extinguish the flames, or—if necessary—to escape from the building. Lessons of this kind, imparted by practical methods, would become a source of strength in after life and would go far to check the recurrence of fire outbreaks, with their entailed loss of life and capital.

Take, for example, the case of an overturned oil lamp. There is a sudden and alarming blaze, but if action is taken at once, the damage may be confined to the carpet, cloth or what not upon which the lamp actually lies. To throw water on the conflagration is useless. The burning oil will only be forced over a larger area. The aim should be to absorb the oil and smother the flame as much as possible, and this may best be done by means of some non-flammable powder—such as flour, sand, earth from the garden or anything of the kind.

Another point worth remembering is the use of the soda-water syphon as an extinguisher. Suppose that a lamp or candle has ignited a curtain and that the flame has run up the fabric. A syphon of soda water held as shown in the accompanying photograph, and squirted over the flames, will work wonders. Not only does the force with which the liquid leaves the tube allow of its being directed well above the operator's head, but the carbonic-acid gas with which the water is charged helps to deaden the flames.

How to act for one's safety, or to assist another, in the case of burning clothing cannot be better told than in the words of Prof. John Marshall. He says: "If the dress of a woman catches fire, she should at once lie down on the floor, and should crawl in this position either to a bell pull or a door, and call for assistance, or she should roll herself in a rug or blanket. In the event of a man rendering help he should at once lay the patient down, take off his coat and roll her in it, unless he can obtain a blanket or rug, or roll her on the carpet. If a woman renders assistance, she must be careful not to allow her own clothing to touch the victim, but to hold a rug or blanket in front of herself while approaching the flames."

Prompt action without rashness or self-baulking hurry, is the keynote of success in fighting the fire fiend. This applies especially to those who wake from sleep to find the house on fire. Not a moment should be lost, but there should be no wild rushing from a window to a door and back again. First an attempt should be made to get down the stairs. To escape through passages filled with suffocating smoke, tie a wet handkerchief over the mouth and nose, then crawl on the hands and knees, for the smoke tends to rise with the hot air and will be less dense close to the floor.

But if the whole of the lower part of the house is burning and escape by means of the stairs is impossible, preparations must be made for leaving through the window. Tie all the sheets and blankets together by means of "reef knots," which will not slip no matter how much strain is put upon them. Then drop the bedding or mattress from the window in order that there may be some kind of break in the event of a possible fall. Finally make one end of your improvised fire-escape fast to the bedpost, drop the other end from the window, and after making sure that it reaches to or almost to, the ground go down it boldly hand over hand. It should be added that in the case of inexperienced persons there is always considerable risk of a dangerous fall resulting from this means of exit, therefore it should be undertaken only when all other means of escape have failed.

In conclusion a few words may be added respecting the treatment of burns and scalds prior to the arrival of a doctor. The main point to bear in mind is that the air is to be excluded from the affected part as quickly as possible. This may be done by

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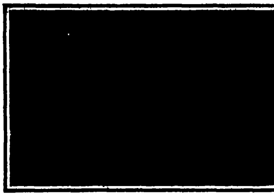


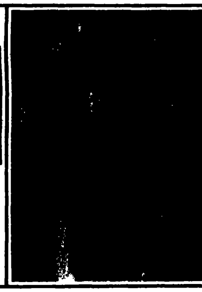
Blazing oil from overturned lamp extinguished by use of flour.

To avoid drawing burnt or scalded limb from clothing cut apparel away with sharp scissors.

Manner of tying sheets, etc., together to form an escape rope.

Crawling method of escape from passages filled with smoke. Handkerchief holds wet sponge in place.

A syphon makes a handy and an efficient fire extinguisher.



Method of using knotted blanket or sheet rope for escape by windows.

HOW TO ACT IN CASE OF FIRE.

THE HEAVENS IN JUNE

BY HENRY NORRIS RUSSELL, PH.D.

JUNE, though less exciting from an astronomical standpoint than May, is still a month of more than usual interest

Halley's comet will, of course, still be the main object of attention. At the beginning of the month it is excellently placed for observation, about midway between Regulus and Alphard (α Hydrae) on a dark sky, setting after 11 P M It will however be much less conspicuous than the week before, and will seem to shrink and fade rapidly as it recedes from us. Its distance on the 1st is about fifty million miles, and this increases steadily, at the rate of three and one-half million miles a day—to which the earth's motion in one direction contributes about one and one-half million miles, and the comet's motion in the opposite direction the remainder

Its apparent motion in the sky is slow, for it is moving almost directly away from us It still travels eastward and southward among the stars, continuing the line of its earlier path but very much more slowly, covering only 13 deg during June, and 5 deg during July

During the first ten days of the month it will still be a fine naked-eye object. Then the new moon will begin to flood the evening sky with light, and drown it out By the time she is out of the way again the comet will be 125 million miles from us, and equally far from the sun, so that little can be seen of it without a field glass With the aid of the latter it can probably be followed all through the month

The display which this comet has given us during May is probably the finest of the last fifty years

Curiously enough, its only rival in the last quarter-century is the great comet which appeared so unexpectedly last January This was at one time much brighter than Halley's comet (owing to its close approach to the sun) but its tail was not so long and it was too deep in the evening twilight to be seen to the best advantage

Daniel's comet of 1907, though intrinsically of about the same magnitude as Halley's comet, was never within fifty million miles of the earth, and so never afforded nearly as fine a spectacle

Back of this is a long barren interval The last previous comet which was at all conspicuous to the naked-eye was the great one of 1882 This was one of the grandest on record, and had a tail over 100 million miles in length but this was directed almost away from the earth, so that it never looked more than 35 deg long—as against over 80 deg for Halley's comet before it left the morning sky Before this comes Coggia's comet of 1874, with a tail of 50 deg long but the last comet, fully comparable in appearance with our visitor of this year, is the great comet of 1861, whose tail was at one time 120 deg in apparent length As in the present case, the earth passed through the tail without any sensible effects other than a general illumination of the sky on the night of passage Three years earlier, in 1858, appeared Donati's comet by common consent the finest of the last half of the nineteenth century

Several of these comets, especially that of 1882, were really much larger affairs than Halley's, but the very favorable circumstances of the present return make it comparable, as a spectacle, with any of them, so far as can be judged from the records

The last news at the moment of writing is that its head proved perfectly transparent during its transit across the sun, and that its tail is so much curved in its own plane that the earth did not reach it till long after daybreak on the 19th Before dawn this morning it was a magnificent object, extending from the eastern horizon half way across the sky, till it was lost in the Milky Way Its total length up to the invisible head was fully 120 deg, according to observations here, and 140 deg as seen at the Lick Observatory a few hours later

THE HEAVENS

As our marvelous visitor fades in the western heavens, we may turn once more to the old familiar constellations. In the north, below the Pole, is Cassiopeia, low on the horizon Above her is Cepheus, and higher still the Little Bear, standing poised on its tail above the Pole Between this and the Great Bear are the long coils of Draco Our initial shows the truly formidable aspect of this monster, whose form, coils and all, can be traced with decided likeness among the stars themselves. The two bright stars β and γ in the Dragon's head are very conspicuous. Two others, of which only one is shown on the map, make up with these an irregular quadrilateral The faintest star of this, ν Draconis, is an interesting double, separable with a field-glass of high power—the distance of the components being almost exactly one minute of arc

The star α Draconis, about midway between the bowl of the Little Dipper and the end of the handle of the Great Dipper, is noteworthy as the pole-star of the ancient Egyptians. About the year 3500 B. C. the celestial pole, in the course of its processional motion, passed very near this star, so that it held the same place in the heavens then that Polaris does to-day

In the northeast we see the great cross of Cygnus, and the brilliant Vega, and due east Altair has just risen Higher up is Hercules, and south of him Ophiuchus, entangled with the Serpent which he carries. Boötes is right overhead, Arcturus being some 20 deg. south of the zenith. Low in the southeast is Scorpio, not yet fully risen. On the right and above is the insignificant group of Libra, and the extensive one of Virgo, now brightened up by Jupiter, in the southwest. Below this, all along the sky from west to south, stretches the mighty length of Hydra, with the Crow and Cup resting upon its back. Due south, far down below Virgo, are many of the stars of the Centaur and the Wolf. Observers in low latitudes, near the tropics, can see below these the two brightest stars of the constellation which, though among the most brilliant in the heavens, have no Greek, Latin, or Arabic names, being too far south to be known to the ancients. The easternmost of the two, Alpha Centauri, is known to all students of astronomy as our nearest neighbor in the heavens—only half as far away as Sirius, which, so far as is now known, comes next.

Farther east, and best seen a little earlier in the evening, is the Southern Cross.

Leo, in the west, and Cancer and Gemini below, complete our list This region of the sky will be the closest watched of all during the month, for the comet is there.

THE PLANETS.

Mercury is morning star all through the month, being best observable about the time of his greatest elongation on the 19th, but as he is then south of the sun, and rises little more than an hour before him, the present opportunity is unfavorable.

Venus is likewise a morning star, rising before 3 A M and very conspicuous.

Mars is an evening star in Gemini and Cancer, setting more than two hours later than the sun.

Jupiter is in Virgo, visible all the evening. He is in quadrature on the 27th, and comes to the meridian at 6 P M

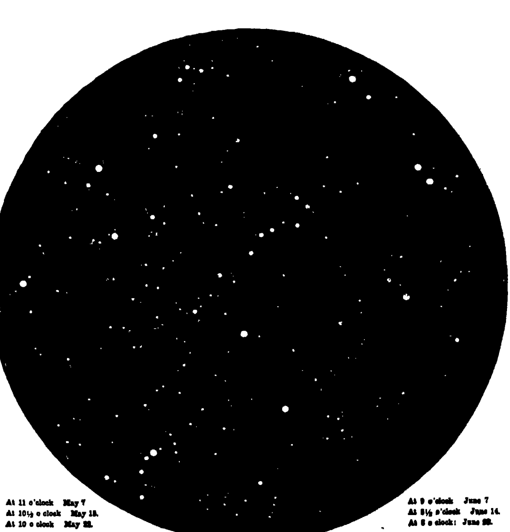
Saturn is morning star in Aries, rising about 2 A. M in the middle of the month On the morning of the 5th he is in extremely close conjunction with Venus, the two being only four minutes of arc apart—too close to be separated by the unaided eye. Unfortunately, the closest approach is at about 9 A. M by eastern standard time, when the planets are invisible in the daylight, and they will be about a quarter of a degree apart at 3 A. M., when we can last see them Observers on the Pacific coast will be able to follow them until they are almost too close to be separated by the eye.

Uranus is in Sagittarius, and crosses the meridian about 2 A. M. in the middle of the month.

Neptune is in Gemini, too near the sun to be observed.

The moon is new at 8 A. M on the 7th, in her first quarter at 11 A. M. on the 14th, full at 3 P M. on the 22d, and in her last quarter at 11 P M. on the 29th. She is nearest the earth on the 5th, and farthest away on the 18th. In her course around the heavens she passes Venus and Saturn on the morning of the 4th, very closely These conjunctions, like that of the planets two days later, happen after the sun has risen for the Eastern States, but will be of interest to western observers.

Besides these, she passes Mercury on the 6th, Neptune on the 9th, Mars on the 11th, Jupiter on the 15th, and Uranus on the 24th, none of them closely.



At 11 o'clock May 7
At 10½ o clock May 15.
At 10 o clock May 22.
At 9½ o'clock: May 31.
At 9 o'clock June 7
At 8½ o'clock June 14.
At 8 o clock: June 22.

NIGHT SKY: MAY AND JUNE.

By the addition of magnesia to castor oil, it is possible to obtain a mixture in the form of a powder, which contains fifty per cent of castor oil and produces the therapeutic effects of the pure oil, and yet is odorless and tasteless. The nature of the compound formed was not completely determined until recently. It is now proved that it is not a magnesia soap, but a simple mixture, for the oil can be extracted in unaltered condition by ether, or by treatment with hydrochloric acid, which dissolves the magnesia.

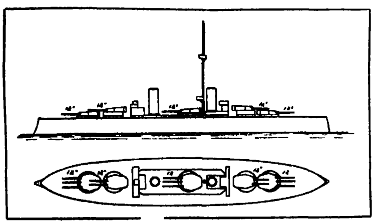
A 13-GUN SHIP: THE LATEST DREADNOUGHT DEVELOPMENT.

BY PERCIVAL A. HISLAM.

There have been many modifications of the "Dreadnought" design since it was first introduced in 1906. The American modification is distinguished by the center-line arrangement of the gun turrets, the German by the powerful secondary armament and by the reported introduction of the triple turret. It has remained for Italy—the home of constructive genius and the real birthplace of the dreadnought itself—to combine in one ship the twin turret, the triple turret, and the center-line arrangement.

Four ships are under construction for the Mediterranean power One, the "Dante Alighieri," was laid down last summer, and is to be launched in September. In the case of this vessel, her power has been exaggerated, for instead of carrying twelve 12-inch guns, as reported, she will have only ten In the case of the other three ships, named "Conte di Cavour," "Leonardo da Vinci," and "Giulio Cesare," it is difficult to say whether their power has been under or over rated. According to first accounts, they were to carry eight 14-inch guns. It now turns out, however, that they will have no fewer than thirteen 12-inch weapons. This is a larger number of single-caliber guns than has ever been mounted in a modern ship, although the Japanese "Satsuma" and "Aki" each carry four 12-inch and ten 10-inch, to say nothing of twelve 6-inch The arrangement of the guns in the Italian ships is distinctly novel There will be three three-gun turrets, one forward, one aft, and one amidships, while a twin turret will be placed forward and aft, so as to bring its guns to bear over the lower turret There will thus be a full broadside of thirteen 12-inch guns, with a fore-and-aft fire of five The secondary battery will consist of eighteen 4 7 inch rapid-fire guns, besides the same number of 3 inch Three under-water torpedo tubes will be fitted The displacement will be 24,000 tons, the main armor belt 12 inches thick, and the speed 22 knots.

The arrangement of the armament in the "Dante Alighieri" is precisely the same as that in the other three ships, save that the midship turret is suppressed, and that the after turrets are on a lower level than those forward As will be seen from the accompanying sketch, the deck runs straight from bow to stern in the three other ships. The "Dante" will have a displacement of 18,300 tons and a speed of 23 knots. The four ships are to be completed in 1913.



NEW ITALIAN BATTLESHIPS WHICH WILL BE THE FIRST TO CARRY THIRTEEN TWELVE-INCH GUNS.

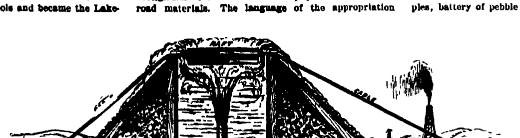
HOW THE LAKEVIEW GUSHER WAS CAPPED.

BY E. C. CARR.

Last week's issue of the SCIENTIFIC AMERICAN contained a description of an oil well in the midway district near Bakersfield Cal, which on March 15th suddenly blew out the drilling tools and became the Lakeview Gusher, the largest oil gusher in California, blowing out at the rate of over 40,000 barrels of heavy crude oil a day The force of the gas pressure was so terrific that the derrick was ripped to pieces, and oil spray was literally sent for miles in every direction How to cap this well was a serious problem. For several weeks no attempt whatever was made to check the flow. A tentative attack was then made to fasten down a wooden roof over the head of the well Although the roof was made of 16 by 16 timbers, the gusher tore them to splinters.

The following plan was then successfully adopted:

The gusher had by this time broken out in several small oil fountains in addition to the main stream. These additional openings were smothered by means of successive bulwarks of brush and sand. A stockade of heavy planks was then built around the spouting well. The walls of the stockade were 15 feet high. On one side of the stockade a slanting runway was constructed. A heavy raft 15 by 20 (approximately) was then built, resting on this runway like a ship on the ways. Heavy wire cables were fastened to the four corners of the raft. The cables at the two lower corners were made fast to heavy pipes buried 15 feet under ground. The cables attached to the upper corners of the raft, as it lay on the ways, were run over the top of the stockade. At a favorable [illegible] these upper cables were hauled taut, and the raft was [illegible] into position like a hatch. The two lines [illegible]bles, which had served to haul up the raft, were then made fast to buried pipes. The result was that the stream of oil was hurled against what was virtually a raft anchored in midair. The raft, held up by the force of oil, is about 15 feet above the mouth of the well and just above the stockade Although this does not actually stifle the gush of oil, it has very much lowered the height of the fountain, and thus has resulted in a vast saving of oil



ARRANGEMENT OF STOCKADE AND RAFT WITH WHICH THE LAKEVIEW GUSHER WAS CAPPED.

A National Good Roads Laboratory.

The Agricultural Appropriation Bill approved March 3rd, 1893, contained an item appropriating $10,000 to enable the Secretary of Agriculture to make inquiries into systems of road management through out the United States, to make investigations in regard to the best methods of road making and prepare publications and assist agricultural colleges and experiment stations in disseminating information on this subject. In pursuance of this authority, the Office of Road Inquiry was established

During the next two fiscal years the appropriations and the wording of the bill remained the same The appropriation for the fiscal year 1897 was reduced to $8,000, and a provision was added authorizing the investigation of road-making materials in the several States. The appropriation remained $8,000 annually during the fiscal years 1898, 1899, and 1900, and no change was made in the wording of the bill, although the name of the office was changed from "Road Inquiry" to "Public Road Inquiries" in the fiscal year 1899

The Agricultural Bill for 1901 carried an appropriation for $14,000 and provided for conducting experiments in the city of Washington and elsewhere and collecting, digesting, reporting, and illustrating the results of such experiments. The appropriation for 1902 was $20,000, and the bill provided for the investigation of the chemical and physical character of road materials. The language of the appropriation bills has remained practically unchanged up to the present time, except that the name of the office was changed from "Public Road Inquiries" to the "Office of Public Roads" and a statutory organization was provided in the Agricultural Bill approved March 3rd, 1905 In the appropriation bill for 1909, the rent or purchase of road-making machinery was forbidden The total appropriations to the fiscal year 1909 inclusive amount to $473,440 The estimate for 1909-10 as approved by the Secretary of Agriculture is for $128,450

The Office of Public Roads is under the jurisdiction of the National Department of Agriculture as shown above. It has no administrative duties and exercises no control whatever over the roads of the United States, its functions being entirely scientific and educational. No appropriations are made by the national government for roads except on government reservations. At the present time there are sixty-seven officials and employees on the rolls of the office The work of the office is divided into three branches, namely, the laboratory work, which is organized as the Division of Tests, the engineering work, which is known as the Highway Division, and the economic, statistical, road management, and miscellaneous work which is organized as the Division of Road Management.

As the Division of Tests, which may be regarded as a National Good Roads Laboratory, is considered to be the most completely equipped road material laboratory in the world we give the following detailed description of the plant and work The Assistant Director and Chemist has charge of the Division of Tests He has as his assistants a testing engineer and an assistant chemist The chemical laboratory is under the immediate direction of the assistant chemist and the physical testing of materials is under the testing engineer There is also in the Division of Tests a petrographic laboratory with a petrographer in charge The routine testing of materials conducted by the Division of Tests consists of microscopic and chemical analyses of specimens to determine their mineral composition and proper classification, and physical tests to determine their cementing value hardness, toughness, resistance to wear, water absorption, and density (Bulletin 79 Bureau of Chemistry)

In addition to the routine tests special studies are made regarding the use and composition of asphalts, oils, tars, compounds various emulsions, and salt solutions, with the view of preventing dust and preserving road surfaces (Bulletin No 34) Other investigations include research into the decomposition of rock powders (Bulletin No 28, Circular No 38 and Farmers' Bulletin No 239), the testing of clays for use in paving brick burnt-clay and sand clay roads (Bulletin No 27 and Farmers Bulletin No 311), and the corrosion of iron culverts bridges, and fence wire (Bulletin No 30 and Farmers' Bulletin No 239)

The equipment for the physical testing laboratory is as follows

Large impact machine for testing paving brick, impact machine for testing binding power of rock dust, impact machine for testing the toughness of rocks, Olsen testing machine for tensile, cross bending and compression tests, capacity 20,000 pounds, Riehle testing machine for testing tensile cross-bending, and compressive strengths capacity 200,000 pounds, delicate platform scales, hydraulic machine for molding briquettes, torsion balance, abrasion machine for testing resistance to wear of rocks, vacuum pump, diamond saw and grinding laps for making thin rock sections for microscopic examinations, ball mill for grinding rock samples into powder centrifugal pump, diamond core drill small rock crusher, grinding disk for testing the hardness of rock samples, battery of pebble mills for pulverizing rock powders, Westinghouse air compressor, hot air bath, gas furnace, and a complete cement testing outfit consisting of a Fairbanks torsion machine, Gillmore's needles, standard sieves, briquette molds, soaking tanks, etc

The equipment for the machine shop where testing machines and other apparatus are made and repaired is as follows

Speed lathe, engine lathe, drill press, power hack saw, precision lathe, saw table, universal trimmer The chemical laboratory is equipped with the necessary chemical apparatus used in making analyses of rocks clays cements, and bituminous substances It is provided with compressed air vacuum, gas, hot and cold water steam, and electricity The petrographic laboratory is provided with a petrographic microscope of the latest Fuess model, which besides the usual attachments is provided with a revolving analyzer in the tube to aid in the determination of very low doubly refracting mineral, and a Schwartzman scale for the measurement of optical axial angles. The methods used for examining and classifying rocks are fully set forth in Bulletin No 31

The road material laboratory was established in December, 1900 and from that time until November 30th, 1908 3 018 samples of road material were tested from practically every State in the Union The results of tests made up to January 1st, 1908 and a brief description of the present methods of making routine tests are shown on Form No. 28

NEW TWO-CYCLE MOTORS

DEFECTS OF THE TWO-CYCLE ENGINE AND HOW THEY ARE OVERCOME

A belief is growing among gas engine experts that the greatest improvements in gas and gasoline motors must come in the future from some type of engine which gets increased power from its cylinders by eliminating the idle revolution of the four-cycle type It is conceded that four-cycle design has practically reached the limit of its possibilities the advent of the automobile having drawn the services of the brightest men in the gas engine field, the result of whose work is seen to-day in the splendid examples of gas engines found in even the cheaper kind of automobiles However many designers feel as was expressed by one prominent engineer, that "It is inconceivable that the four-stroke cycle with its small utilization of one-half of the piston strokes will be accepted as the finality of development, the two-stroke cycle as now applied is equally unsatisfying for reasons that are familiar to all students of the question"

It is apparent that the chief efforts toward improvement are now being made with a view to eliminating the defects heretofore common to the two-cycle type

The chief defects of the usual two-cycle engine may be summed up as follows

1 The explosive mixture is taken into the crank case resulting in leakage and in possible explosions in the base

2 The new charge comes into direct contact with the hot burned gases, causing possible pre-ignition and some loss of gas at the exhaust

3 The charge is not large enough in volume because the crank case is an altogether inefficient compressor on account of its very large clearance This means a small charge and also a large percentage of dead gas left in the cylinder

4 The power is not increased materially by the double number of explosions because of the weak charges and poor economy

Several recent two-cycle engines meet these defects in different ways The Newcomb engine was recently exhibited before the Automobile Club of America This is a two-cycle engine using the crank case to supply air only This air blows out the previous charge and furnishes oxygen to burn the next charge of fuel The fuel is injected directly into the cylinder from a plunger pump, the quantity being controlled by regulating the stroke of the pump The gasoline is directed downward into a small cup on the head of the piston When the piston rises this cup or pocket is in the vicinity of the spark plug so that there is always an ignitable mixture near the plug even when running on very light load This arrangement avoids several of the defects of ordinary two-cycle engines The charge is limited, however by the amount of air which can be supplied from the crank case, which would scarcely exceed 75 per cent of the displacement of the piston, leaving the other 25 per cent and the clearance space filled with burned gas This engine will undoubtedly be more powerful, economical, and reliable than the ordinary two-cycle motor

Another improved type of two-cycle engine is that employing a differential piston This engine leaves out the crank case entirely as a means of supplying

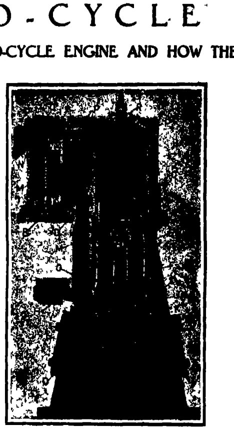


Fig 1.—Shortt two cycle motor.

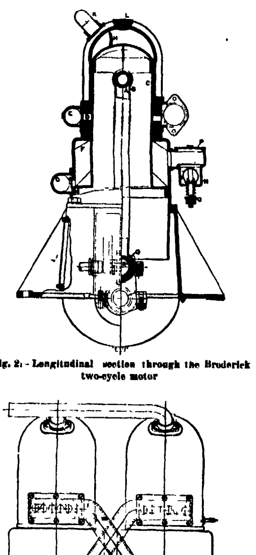


Fig. 2.-Longitudinal section through the Broderick two-cycle motor

the charge or air and compresses the charge initially in an annular chamber formed by a differential or two-diameter piston. Two cylinders are worked together, the lower piston of one compressing the charge for the other This permits getting a full charge and large capacity, though the loss of fuel through the exhaust is likely to be greater The leakage loss and base firing are eliminated This type of motor is used on the Elmore automobile and a light-weight engine weighing but 3½ pounds per horse-power and constructed after the design of J W Broderick is now being manufactured for aeroplanes and other aeronautic purposes.

A good idea of the method of operation of this motor can be had from the diagrams we reproduce The cross-section of one of the cylinders shows the large compressor piston on the lower end of the working piston *C* On the down stroke the large piston draws in a charge of gas from the carbureter through the automatic inlet valve *M* On the up stroke it compresses this charge in the chamber *F* above it and in the pipe *G* leading across to the inlet port of the second cylinder Just before the piston of the second cylinder opens the exhaust port, it uncovers the inlet port *D* and the charge compressed in the transfer pipe *G E* leading from cylinder one to cylinder two, passes into the cylinder and is directed upward by the deflector *H* In the motor shown, the connecting rods *A* are of steel tubing for the purpose of saving weight. The spark plugs are located in the dome-shaped cylinder heads, where they are most effective in igniting the mixture This type of two-cycle motor offers the advantage that there is no possibility of leakage of the initial compression after the crank-shaft bearings have become worn, and there is no necessity of making these bearings heavier and longer than usual for the prevention of undue wear Neither is there any trouble from back fires in the crank case, which sometimes cause serious damage

The new cycle motor is a recent invention of C A. Dawley, member of the American Society of Mechanical Engineers This engine has some features of both of those described above It uses a differential piston and handles the charge in an annular chamber, but it also compresses air in the crank case Owing to the enlarged diameter of the piston in the crank case, the air supply is in excess of the piston displacement. The air displaces the exhaust and scavenges the cylinder before the new charge is admitted The admission of the new charge is controlled by the valve *F* in Fig. 5, and the timing is such as to introduce the charge after the cylinder is cleared of burned gases, but before compression commences. This evidently will give a full charge of air and fuel and prevent any loss of fuel or premature ignition When used on gasoline this engine may use a carbureter, in which case an extra rich mixture would be drawn into chamber *B*, while the additional air required for combustion would come from the crank case Or a fuel pump may be used as in the Newcomb engine, except that in this case the gasoline would be delivered into port *M* and then blown into the cylinder by the charge of

(*Continued on page 449*)

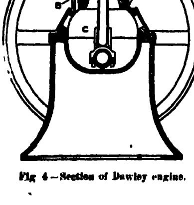


Fig 4—Section of Dawley engine.

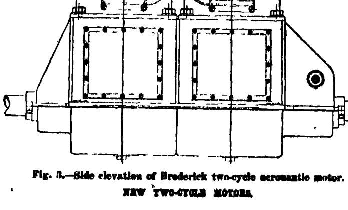


Fig. 3.—Side elevation of Broderick two-cycle aeronautic motor.

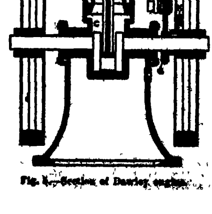


Fig. 5.—Section of Dawley engine.

NEW TWO-CYCLE MOTORS.

The Home Laboratory

A ROUGH AND READY GALVANIC BATTERY.

BY A. J. JARMAN

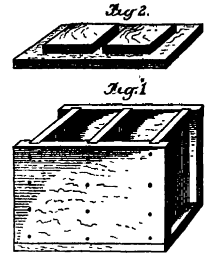
The best battery for experimental work in the workshop or laboratory is one of the rough-and-ready type that will give a moderate current of electricity of say three or four amperes with an electromotive force of 1.5 to 3 volts. Such a battery is suited for the exciting of a powerful electromagnet, for magnetizing purposes, operating an induction coil, and for electro silver plating, electro brassing, or electro coppering either by the hot or cold process, and for electro gilding. The following description will enable anyone who can handle woodworking tools to construct such a battery consisting of two cells capable of being coupled so as to give the current of one large cell or in series so as to yield the current of one cell and the electromotive force of two. This latter plan is the one best suited for coppering, brassing or electro nickeling. This type of battery has been used, and is still used by the writer for all the purposes mentioned, for over five years, so it has been put well to the test of experience.

The wood used in making the battery must be thoroughly well seasoned. An old board that has been kept years in an office or a loft will prove to be just the thing required. The board should be 1 inch thick. Cut a strip 5 feet long and 8 inches wide. Plane this smooth all over and then cut three pieces 13½ inches long, and three pieces 5½ inches long. The latter will form the ends and central division of the battery. The side pieces must be grooved so as to receive these pieces with a very nice fitting joint as shown in Fig. 1. The bottom piece must be made as shown in Fig. 2, with two pieces of wood cut exactly 5 inches square, this also being the inside measurement of each cell. These squares must be held in place by means of screws that are inserted from the underside of the bottom board and penetrate to within ¼ inch of the outer surface of the squares. They should also be coated with a thick shellac varnish (not glue) before being fastened in place. The grooves in the side pieces and the ends of the division pieces must also be well coated with thick shellac varnish, after which the pieces should be driven tightly together and held by nails or screws. Nails driven diagonally make the best job because they will draw the woodwork together more firmly than screws, and resist direct strain better. The object of using shellac is to insure a perfect acid proof joint, and the 5-inch square pieces where pressed into position form a bottom so firm that no acid liquid will penetrate.

When the battery has been put together it must be lined on the inside with a coating of burning hot pitch. Use an old saucepan to melt the pitch in. Pour some into one of the cells and tilt the battery first one side then another until all four sides have been submitted to the hot pitch. Pour the pitch back into the saucepan, take a strip of square or flat iron, make one end red hot, and press this well into the corners and around the joints at the bottom, so as to secure a perfect coating of pitch at these joints. Now pour the hot pitch into the cell again so as to be sure that all parts are well covered. Treat the second cell in like manner. Having the case now well put together, finish the outside by giving it two coats of shellac varnish mixed with crocus (oxide of iron). This paint will resist the acid solution used in the cells and give quite a nice finish to the work. To complete the battery procure two zinc cylinders 7 inches high, 3¼ inches inside diameter, and ⅛ inch thick. Also two round porous pots 3 inches diameter and 7 inches high. Also two carbon plates or blocks 7 or 8 inches long, ½ inch thick, and 2 inches wide. Attach two brass battery clamps to these with a strip of sheet copper folded over the top of the carbon block. This is an important item. Its use will protect the brass clamp from being corroded by the acids. The zinc cylinders can be purchased with a copper strip and binding screw attached. The zinc cylinders must be amalgamated by dipping them into sulphuric acid 1 part, water 8 parts, and then rubbing all over inside and outside with quicksilver. Place these zincs in the wooden vessel. Make up a mixture of sulphuric acid 1 pint, water 8 pints in a stoneware pitcher, and allow it to become cold. In another vessel make a mixture of water 4 pints, bichromate of sodium or potassium 12 ounces, sulphuric acid half a pint. Allow this also to become cold. The battery is now charged by pouring the bichromate mixture into the porous pots, around the carbon blocks and then pouring the sulphuric acid mixture into the outside space around the zinc cylinders. The battery is now ready for any purpose required and will keep in good action for about six hours continuously. When not in use the zinc cylinders must be removed and placed into a stoneware crock filled with water, and the bichromate mixture must be returned to the vessel it was made in. The carbon block can also be stood on end upon blotting paper or in a wide mouthed pickle bottle. The sulphuric acid mixture can be allowed to remain in the wooden battery cells. For intermittent use such a battery will work well for months and meet every requirement for small work, either in the workshop or laboratory. No amount of hard use will injure it, if well put together as described. No acid solutions will affect it, although the liquid may be left in the cells year in and year out.

Fig. 2.

Fig. 1



A ROUGH AND READY GALVANIC BATTERY

SAFE GASOLINE TANKS

BY DR. F. W. BREMER

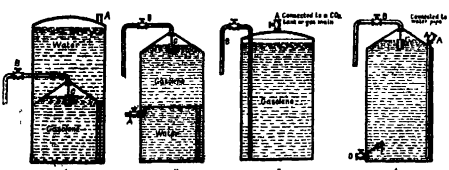
As gasoline explosions are due to a mixture of gasoline vapor with air (accidentally ignited, of course) I think the air in a gasoline tank could well be replaced either by water or a non-oxidizing gas such as carbon dioxide, after the manner here illustrated.

In the first two designs water is used. In Fig. 1 the weight of the water forces the gasoline out of the lower tank through the stopcock *B*. The valve *C* is so constructed that it floats when the water reaches it, closes the opening, and thus prevents the water from flowing out. To refill the tank with gasoline, a suction pump is connected to the stopcock *A* and the gasoline is siphoned into the lower compartment through the stop-cock *B*. The latter prevents the gasoline from escaping.

Fig. 2 is practically the same, but to discharge the gasoline through the stopcock *B* air must be pumped into the lower part to force the water into the gasoline tank above. To refill this tank with gasoline, the stopcock at *A* is opened, letting the air out and the weight of the water then siphons the gasoline into the tank above through the valve and stopcock *B*.

In Fig. 3 a carbon dioxide tank is connected to the pipe *A* and the pressure of the gas then forces the gasoline out through the pipe *B*.

In Fig. 4 the stopcock *A* is connected to the water main or pipe when the pressure of the water forces the gasoline out through the stopcock *B*. The valve *C* prevents the water from escaping into the gasoline cans through the stopcock *B*. To refill the tank, the stopcock *A* is closed and stopcock *D* is opened, and the water flowing out through the latter will draw the gasoline into the tank through stopcock *B*. The valve *B* is adjusted to sink in gasoline and thus close the outlet, preventing escape of gasoline through the stopcock *D*.



SIMPLE METHODS OF MAKING GASOLINE TANKS SAFE.

PLUG CONNECTOR

To make a plug connector for use in an electric light socket, all that is required is a burned out incandescent lamp and a number of feet of heavy lamp cord. Break the glass globe out of the lamp, leaving only the base. Then break away the glass tube that protects the leading in wires, being careful not to injure them. Now untwist about a foot of the lamp cord, scrape the ends clean and slip a short length of rubber tubing over each end. Solder the ends to the leading in wires in the lamp base and then push the rubber tubes down over the joints. Fill the socket with plaster of Paris, letting it project up above the top of the plug about an inch so as to form an insulated top to screw the plug in by. This plug connector is suitable for small motors, portable lamps, and any other apparatus that draws only a small current. It cannot be used for large currents as the heavy current would fuse the leading-in wires in the plug.

A SIMPLE APPARATUS FOR EMPTYING CARBOYS

BY H. H. P. CLARKE.

A very simple, effective and easily set up apparatus for emptying carboys of acid, etc., may be made in the following way from materials found in every laboratory. This will be found to be far superior to the acid pump or the old-fashioned method of tilting the carboy, catching the liquid in a jug, and then pouring it into bottles. For no fumes can escape, and this is an important factor when dealing with strong ammonia or hydrochloric acid (spirits of salts).

Say one wishes to fill with hydrochloric acid or another liquid any number of bottles from a carboy.

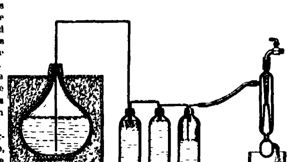
Fit every one of the bottles with two-holed rubber corks and then through each hole put a piece of glass tubing bent in the form of a right angle with sides about three inches long. Connect one piece of glass tubing in one bottle to another piece in another bottle with a small piece of rubber tubing; the free piece of this bottle with another piece in another bottle, and so on until you have all the bottles connected up in one straight line.

Connect the free tube at one end of the line with a piece of rubber tubing to a long bent glass tube passing to the bottom of the carboy.

Attach the other free tube at the other end of the row of bottles to a glass filter pump or any other suction apparatus with a piece of thick walled rubber tubing. Then we have the apparatus as illustrated herewith.

Turn on the water tap connected with the filter pump and the acid will be drawn up the tube leading from the carboy and into the first bottle. As soon as this is filled the acid will run into the second bottle, and so on until the carboy is empty or the requisite number of bottles are filled.

If one hasn't many corks all that is necessary is to fill say three or four bottles. When these are filled they can be disconnected and others put in their place. But it must not be forgotten to turn off the water tap and so stop the flow of liquid before making the change.



APPARATUS FOR EMPTYING CARBOYS

If the liquid in the carboy is sulphuric acid (oil of vitriol) or any other liquid that attacks rubber the two bent tubes connecting bottle to bottle may be made in one piece and if care is taken to push the ends of the tubes below the end of the corks the liquid won't reach up to them and so they will not be hurt in the slightest. In fact no rubber connections may be made use of except from the suction pump to one end of the line of bottles though, of course it is more convenient to use them.

A glass filter pump is the best to use because any fumes that may perhaps come over have no corroding effect on it, as they would have on a metal one.

MAKING YOUR OWN PERFUMERY.

BY A. S. ATKINSON

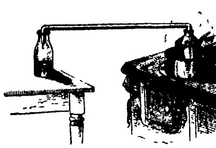
The manufacture of perfumery has always seemed a difficult process to many, and without doubt the blending of certain kinds of perfumes is a matter of much scientific and skillful manipulation, but on the other hand, the most commonly used perfumes can be made at home with simple apparatus and without much expense or trouble In many parts of the country, flowers are so abundant that one can harvest all that are needed for manufacturing at home perfumes enough for a year's use

A perfume garden should prove as profitable as one of fruits or vegetables We plant gardens for cut flowers and for flower seeds, but few raise flowers for perfume making Enough perfumery is sold in this country annually to make a yearly tax of nearly ten dollars on every family This amount is not evenly distributed, but each woman spends enough to make it worth while, if she has the garden space to try a hand at making her perfumes at home

One must devote time to the cultivation of certain flowers which thrive luxuriantly in the vicinity In many parts of the country roses thrive so luxuriantly that fields can be sown with them, and an abundant crop raised In other sections the rose is too slow-growing for this purpose, but the violet takes its place Again, it must be the jasmine, the tuberose, the orange blossom, or lavender Whatever flower it is that thrives and possesses delicate but powerful fragrance should be chosen for the work

Direct distillation is the most satisfactory way of making perfumery The still is a simple affair and it can be made out of articles found in the average home Take an ordinary tin oil can, scour it, and purify it of all oil odors Stop the spout completely, and fit a cork in the top through which the oil is poured From a hardware store get four feet of copper tubing (tin or galvanized iron pipe may also be used) The tube should be bent downward at the ends

The tin can should be filled with a pound of flower



HOME-MADE PERFUME STILL.

petals gathered fresh in the early morning Pour over these petals eight fluid ounces of alcohol Then put the can in a saucepan half filled with water, and place on a stove, where the water can be kept at the boiling point. A hole should be cut through the cork of the can just large enough to receive the metal tube. Place a quart jar on a table nearby, and insert in it the other end of the tubing This jar should not be sealed, or distillation will not go on properly

When the water boils, the alcohol in the can is heated, and this process extracts the perfume from the flower petals, and gradually causes distillation through the tube into the cold jar on the table The alcohol thus distilled will carry with it the true attar of the flowers Alcohol has a peculiar property of extracting and holding the scent of flowers As fast as distillation goes on, the contents of the jar should be emptied into glass bottles and securely corked and sealed with paraffin In blending perfumes of several flowers, do the mixing after each one has been distilled separately Do not mix the flowers in one still

Another method of using this still is to employ water instead of alcohol for distillation Instead of attar we get the essential oil of the flowers, and this rises and floats on the surface of the water in small globules, which must be skimmed off carefully, and immediately bottled and kept cool and air tight. When sufficient oil is obtained, it should be mixed with alcohol to retain the odor indefinitely One may distill with water any number of kinds of flowers, and with the essential oil properly bottled, blended perfumes can then be made A few drops of several kinds of oil are poured into a bottle containing a certain amount of alcohol, and when shaken thoroughly one has a delicious fragrance for home use For instance, eau de cologne is made by pouring into a glass bottle a pint of alcohol, and adding half a drachm of home-made attar of rosemary and twenty drops each of the attar of orange peel lemon peel, and bergamot peel The distillation of these fruit peels is another desirable home industry Cut up fresh orange or lemon peel and place it in water in the tin can, and heat as for use in flower leaves The essential oil of these peels will then be gradually distilled into the other receptacle Skim off the globules, and confine in corked bottles.

Besides distillation, we have the process of absorption, which anyone can do at home with little trouble and expense It is slightly more complicated, but it will extract the perfume of more delicate flowers, such as the violets, with greater success. This process consists of covering two large shallow pans or soup plates with a layer of melted suet. The layer should be half an inch or more thick When the fat has hardened, gather the violets, jasmine, or tuberose flowers, and cover the suet thickly with them Then place one plate over the other, and force down firmly. Wrap the plates tightly in paper, so that the perfume will all be retained In twenty-four hours the suet will have absorbed nearly all the perfume Then quickly remove the dead petals, and replace with more fresh ones Repeat this operation for several days or even for a week, so as to secure a strong supply of odors. When enough petals have been robbed of their odor, remove the top plate and cut the suet into small pieces, and drop them into a wide-mouthed bottle or glass jar containing alcohol The transference should be made as quickly as possible, and with least exposure to the air Then close the bottle or jar, and seal with paraffin to make air tight As the suet absorbed the fragrance of the petals, so will the alcohol rob the suet of its concentrated extract. Every day the bottle should be shaken a little, and in a fortnight the alcohol should be poured off through a strainer into bottles and corked

Besides making the liquid perfumes, one should consider sachet powders and perfumed pastes. These have their use in every household A rose paste is made by steeping rose leaves in water, and pounding with a mortar until reduced to a paste. This maceration should be thorough, and can be done with an ordinary rolling pin Now add a drop or two of your home-made attar of rose, and permit the paste to dry in an air-tight receptacle The paste will grow quite hard, and can then be cut into any shape desired A piece placed in a drawer will scent the place for a long time If the pieces not in use are kept air-tight they will retain fragrance indefinitely, and will always be ready for instant use Laid in linen and clothes presses, they add that subtle fragrance to the fabrics which so many like

Sachet powders are as numerous and as varied in fragrance as colognes. One may compound them out of flower petals, spices, and perfumes to suit individual preferences The art of making sachets is very simple and inexpensive If we add to these attars and essential oils such simple articles purchasable at any drug store, as iris root, musk, and cochineal (the last for coloring only) and such spices as cloves, cinnamon, and ginger, we have all the materials that a small laboratory requires for making a dozen kinds of popular sachets. Lavender seeds raised and cured at home make a sachet suitable for those who like this odor Another is manufactured by mixing iris root and ground cloves with a little musk and attar of roses, the whole moistened with a little alcohol, and then rolled and kneaded into a paste, which in time grows quite stiff A few pieces of this distributed around in the clothes press will add a delicious odor to garments. For gifts, appropriate bottles and ribbons or boxes may be purchased cheaply at the stores, or silk and damask can be obtained for concealing sachet or perfumed pastes, and pin cushions may be made and scented indefinitely by inclosing a good piece of the perfumed paste in the center

AN EXPERIMENT IN SOUND.

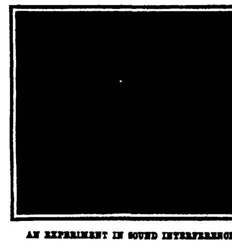
BY W. E. CARR.

Those who have had the good fortune to travel through a virgin tropical forest could hardly fail to have been impressed by the death-like stillness which pervades all nature between the hours of 1 and 4 P M This is the thermal noon of these regions, when all life, weary with the battle with the terrible heat, seeks repose in a much-needed siesta No sound is heard save perhaps the slight rustling of a leaf, or the plaintive grunt of a tardogradus as he answers the call of his mate, or reaches out for a new caucho leaf with which to satisfy a never-ending appetite

Under these circumstances Humboldt, the great German traveler, who was camping twelve miles from the falls of the Orinoco River, was astonished to find that no sound *from* this source reached his ear, while eight hours later, during the night, when the woods were rendered a perfect pandemonium by the shrieks of panther, jaguar, and monkey, the sound of falling waters broke with astonishing clearness upon his ear. What is the explanation of this phenomenon? And why, for example, do the citizens of Washington hear so distinctly, at night, the heavy trains as they pass over the Potomac railroad bridge, while during a calm, sunshiny day they listen in vain for the noise of the moving cars? The very natural explanation that the noise of the day traffic masks the sound of the cars does not suffice, as the experience of Humboldt proves. Some light is thrown upon this problem by a recital of the experience of the writer, who [illegible] upon a bluff forty or fifty [illegible] large, level, low ground, from which [illegible] see the hunters leading their game [illegible] discharge, and the falling game, but [illegible] reached his ears; while again, [illegible] five minutes [illegible] with conditions apparently unchanged, even the conversation of the sportsmen became audible.

Prof Tyndall has described this phenomenon, and attributed it to large masses of air, different in temperature and density from the surrounding atmosphere, drifting in between the ear and the source of sound These "ear clouds," for veritable clouds they are, as far as the human ear is concerned, though perfectly transparent to the eye, possess in a marvelous degree the faculty of reflecting sound waves.

Following is the description of a simple experiment which, if thoroughly understood in all its bearings, will enable one to explain some of the most apparently complex phenomena in nature. Everything has its own period of vibration, that is, the rate at which it naturally swings, or vibrates—not only a tuning fork, but a column of air, and even a house, a tree, or a ship Other things being equal, the longer the object the slower the swing; just as a tuning fork with long prongs swings slower, that is, gives a lower note, than one with short prongs, which swings faster and gives a higher note. Now take a fork giving the note C, which is due to 512 vibrations per second, energize it by bowing or by striking it with a hammer, and hold the fork before the mouth of a bottle, say 6 inches deep and 2 inches in diameter. Instantly you hear an increase in the intensity of the sound, because the column of air inclosed by such a bottle will vibrate the same number of times per second as the fork. Now hold a second similar bottle between the prongs of the fork, as in the accompanying photo-



AN EXPERIMENT IN SOUND INTERFERENCE.

graph, and the sound is practically extinguished, because the crests of the waves entering one bottle coincide with the troughs of those entering the other Under these circumstances there is always interference, or silence Now introduce a piece of cardboard between the mouth of the bottle and the vibrating prong, the conditions of interference are destroyed, and loudness is restored. But an ear cloud is quite as effective as a piece of cardboard Place a burning match or a hot poker beneath the mouth of either one of the bottles, and as the thin layer of warm air reaches the opening it acts as a curtain, reflects the sound waves, and instantly the loudness of the fork is restored Thus is demonstrated a significant and wonderful fact, the power of a thin layer of air to reflect sound quite as effectively as a board. Now, what are the physical conditions obtaining during the day between the ears of the citizens of Washington and the bridge over the Potomac River? The sun is shining, the atmosphere is still, a hot stratum of air rises from a metal roof, another slightly cooler from a grass plot, another of a different temperature from a concrete street, etc. Many strata of different temperatures intervene between the ear and the bridge. As we have just observed the effect of one stratum, we can readily realize that several would possess the power of completely extinguishing the noise of the moving trains. At night, on the contrary, the air is homogeneous, the waves are unimpeded and strike the ear with astonishing clearness.

Bearing in mind these facts, many apparently inexplicable phenomena become as clear as the noonday sun.

The use of towing tanks to determine the best form of ships is much older than is generally supposed. A recent article in Engineering describes work of this character done by David Napier on a model of a channel steamer, the [illegible] which in [illegible] inaugurated the [illegible] service between [illegible] and Belfast. The [illegible] we are told, were [illegible] 12 inches wide, [illegible]

Recently Patented Inventions.

Pertaining to Apparel.

COMBINED CORSET-COVER AND BUST-SUPPORTER.—Jennie Mark and Emma Mark, New York, N. Y. The object of this invention is to provide a new and improved corset cover and bust supporter, designed to be worn over the corset to form a corset cover, and arranged to properly support the bust and enabling the wearer to adjust the parts for the purpose and without danger of displaying the adjusting devices through shirt waists of fine thin texture.

FASTENER FOR GLOVES AND OTHER ARTICLES.—L. W. Brown, St. Louis, Mo. If a glove fits closely it is very difficult to effect a closure of the ordinary spring button clasp, the half sections of which are respectively secured on the vent flaps of the glove. To enable the easy, quick, and reliable closure of the two parts of a spring button clasp, a novel attachment has been provided and constitutes the feature of improvement.

HAT HOLDER.—E. J. Guillard, New York, N. Y. One embodiment of this invention comprises a casing, adapted to be secured to a hat, having therein spring controlled slides, provided with holding members guided on the inner rim of the casing, the action of the said holding members being substantially controlled by manually operated means connected with the said slides in the casing.

Electrical Devices.

ELECTRIC FURNACE.—H. W. Hixon, Philadelphia, Pa. An object here is to provide a device in which the zinc is fed into the furnace, the top of which is kept closed so that the zinc vapor is forced to escape at a lower point, preferably the tap hole. To this end Mr. Hixon provides a furnace with a top of double construction so that an upper door may be opened and a charge fed in while the lower door is shut, thereby keeping the zinc vapors within the furnace.

Of Interest to Farmers.

BUG AND WORM KILLING MACHINE.—L. Thorstvedt, Glyndon, Minn. This invention relates to mechanical means for removing and killing bugs and worms, that infest plants or bushes while growing, and the object is to provide details of construction for a power actuated machine which is convenient to control while operating, and that is particularly well adapted for the removal and killing of bugs upon growing potato vines.

AUTOMOBILE MOWING-MACHINE.—C. G. Delano, Berkley, Mass. This invention provides mechanism for propelling and operating a mower by power, provides traction mechanism for the mower adapted to be guided in rear of cutter bar, provides mechanism disposed in operative position in advance of traction mechanism; provides means for lifting the bar off the surface of the ground to avoid obstacles thereon; provides traction mechanism which may be utilized for miscellaneous power purposes, and a suitable reciprocating mechanism for the knives of the bar and operating connections therewith.

COMBINED HAY TEDDER AND MOWER.—W. F. Schanbian, Lima, Ohio. An object of the inventor is to provide means whereby the hay can be tedded and turned during the mowing operation. A further object is to provide a device rapid and clean in its operation. Still further to provide means for adjusting the height of the tedder frame from the ground.

STALK-CUTTER.—J. Michalka and F. A. Michalka, Cameron, Texas. A purpose of the invention is to provide a machine that will not only cut standing stalks at a point near the ground, but which will practically at the same time cut the stalks in very short pieces, rendering it easy to plow the stalks under to enrich the soil, while any fragments that may remain on the surface will not in any manner interfere with the cultivation of a crop.

Of General Interest.

ANCHOR.—J. W. Neal, Koalia, Hawaii. The invention belongs to that class of anchors in which a number of flukes are carried on a yoke frame and have a limited rotary movement relative thereto to engage in the mud or sand. It has in view an anchor in which the flukes are detachably connected and may be increased and decreased in number so that the anchor may offer the requisite resistance.

JIG.—W. A. Bradley, Spokane, Wash. The invention provides a device for rapidly and thoroughly separating the values from crushed ores, by means of which the gangue or tailings [illegible] and which provides efficient means for forcing water or other liquid rapidly back and forth through a screen, to assist in the separation of the material.

REVERBERATORY SOUND-HORN.—W. A. Chapman, Smithville, Ark. The invention enables the manufacture of sound amplifiers as used with talking machines, at a reduced cost; provides for increasing the artistic attractiveness [illegible] of the [illegible] the volume and tone of sound [illegible] resonant and in a natural manner, prevent mingling of sounds with those external, and affords a self-contained and perfectly balanced amplifying horn for sound reproducing machines.

DENTAL CUSPIDOR.—I. M. Hair, Union, S. C. An object here is to provide a portable cuspidor which may be flushed by a stream of water operated by compressed air. A further object is to provide a device in which the flushing operation may be performed through the instrumentality of a foot lever attached to the device, thereby permitting the dentist to use both hands in other work.

FISH NET.—D. P. Gilstrap, Brownwood, Texas. The intention in this instance is to provide a woven net formed of intermeshed cords without floats, sinkers, drawstrings and the like encumbering attachments, and which will run freely upon a single supporting cord. A further intention is the provision of an improved spring trip for the cord. It acts as an animal trap as well as a net.

STAIR.—J. C. Toliver, Ainsworth, Neb. The stairs are of that class in which a chute or wheelway is provided on each side of the steps constituting the stair proper. The invention consists in the construction and arrangement of the chute on the sides of the stairs proper, whereby dust, dirt, or other material that may accumulate upon the stairs may be swept or pushed directly off of the same into the chute.

BOAT.—H. W. Vaniman, Cincinnati, Ohio. The purpose of the inventor is to provide a non-sinkable and non-oxidizable boat comprising a plurality of sections, sundry preferably two of which are of greater size for the center and capable of receiving the other sections therein in nested relation, the said larger sections being then secured together.

BAG HOLDER.—B. Bush, Kennedy, N. Y. Among the principal objects which the present invention has in view are: to provide a bag holder to hold the opening or top of a bag square and in an inclined position; to provide a holder for a bag which will yield to the variation in length caused by the filling of the bag; and to provide a structure which is light, simple, and efficient.

STOPPER RETAINER.—A. C. Boggs, Jr., Fort Dodge, Iowa. The aim in this case is to provide a spout or stopper retainer for oil cans, which can be applied to cans of various types, which can be secured to the spout of the can after the can is finished, which does not interfere with the flow of heavy oil through the spout, and which does not interfere with the introduction of oil into the can.

PYROGRAPHIC POINT.—L. Quosbarth, Newark, N. J. This invention pertains to improvements in the construction of tools or points of pyrographic burners, thermocauters and cauterizing tools, and to the means for securing the tip or point in place. The main object of the inventor is to so form the tip and the securing means therefor that the tip cannot work loose in use, but may be instantly and easily removed when desired to replace or repair.

Heating and Lighting.

LAMP.—W. S. Ryan, Viola, Ill. The present invention not only has in contemplation the location of the supply reservoir in the lamp post or casing, but also the feed tank which supplies the fuel to the lamp, together with means for introducing fluid pressure above the free surface of the fuel in both the reservoir and feed tank, to respectively discharge the fuel in the reservoir to the feed tank above and thence feed the fuel under the pressure to the lamp.

BAKING STOVE.—J. A. Coppridge, Browns Summit, N. C. This invention is an improvement in baking stoves, being especially designed as a stove for use in baking bread, and has for an object to provide a simple construction which will be efficient for the purpose, can be easily taken apart and stored in compact form so it will be convenient for camping purposes.

Machines and Mechanical Devices.

MEANS FOR THE PROPULSION OF VESSELS.—R. P. Nielsen, Tranebjerg, Samsö, Denmark. The improvement relates to the propulsion of vessels and has for its object to provide a cheap and effective propelling mechanism. The pairs of chains being set in motion the vessel is propelled and owing to the inclination of the plates of the blades, they tend to raise the vessel and thereby facilitate its passage through the water.

AUTOMATIC PHOTOGRAPHIC PRINTING MACHINE.—G. W. Ferguson, Plymouth, Wis. The aim of this inventor is to provide means for rapidly printing photographs from negatives by giving each photograph the same time limit of exposure, by means of an automatic arrangement, which makes each photograph exactly the same. By this method photographs may be printed whenever desired without the aid of sunlight as in the old method.

DISPLAY-MACHINE.—J. S. Anderson, Newport, Ky. Among the principal objects which the invention has in view are: to provide a sign in which the exposed matter is continuously changing, and in which the change [illegible] view; to provide a driving mechanism which is positive and smooth in its operation, and to provide a mechanism whereby the display members are brought together to present a continuous surface.

BURGLAR ALARM.—W. G. Tillman, New York, N. Y. This alarm is more especially designed for use in connection with doors so that when the door is opened by a burglar or other unauthorized person, then the alarm mechanism is actuated to sound a bell, and when the door is returned to closed position the sounding of the bell is temporarily continued.

WIRE-NETTING WEAVING MACHINE.—C. E. Bucu, Mosman, Sydney, New South Wales, Australia. In the present patent the invention has reference to certain improvements in wire-netting weaving machines and its purpose is to dispense with the tube cases and the connections at present used and consequently with the necessity for the special coiling.

JOINTED FIGURE.—G. W. Ferguson, Plymouth, Wis. This figure may be of wood or other material, and the construction adapts it to receive many adjustments of its head and all other members, thus rendering the mechanical simulation of a human animal, fowl or reptile figure, grotesque and very amusing.

TYPE WRITING MACHINE.—W. C. Paul, New York, N. Y. The purpose here is to provide an improvement particularly of the wheel class of machines, or class wherein a wheel is mounted to turn upon a spindle, and to provide means for automatically operating a type wheel to the various printing positions corresponding to the keys depressed, and for automatically locking the wheel in position during the operation of printing.

CENTRIFUGAL MACHINE.—F. Roberts and A. H. Gibson, Lehi, Utah. To empty the sugar, the machine is slowed up somewhat and the hollow shaft being elevated the bracket is swung so that the horizontal portion thereof projects over the casing. The hand wheel is now turned to lower the hollow shaft through an opening in the top of the casing, after which the lever is turned to bring the paddle into position. After the sugar is loosened the lever is operated to swing the paddle into position and the hand wheel is rotated to elevate the paddle from the casing after which the side of the bracket may be swung to the side of the casing out of the way.

COPY HOLDER.—B. F. Pertz, Moro, Ore. The main object in this patent is to provide a holder which will bring the lines of the copy into view of the operator consecutively as the platen is rotated for line spacing. A further object is to provide means for operating the holder so that it will feed the copy faster or slower and in such a manner as to be entirely independent of the rotation of the platen.

Prime Movers and Their Accessories.

INTERNAL-COMBUSTION ENGINE.—P. Daniel, New York, N. Y. In the present patent the invention relates to certain improvements in 2-cycle internal combustion engines, and relates more particularly to the means employed for supplying the fuel to form the explosive mixture and for automatically controlling the amount of fuel admitted.

OIL-PROOF SPARK PLUG.—F. J. Beatty, New York, N. Y. The improvement relates to internal combustion engines and its object is to provide a spark plug arranged to prevent oil or the like splashed up against the plug from passing into the spark gap or into the interior of the plug, thus protecting the cap against deleterious influences of the oil and keeping the plug at all times in effective condition.

ROTARY INTERNAL COMBUSTION ENGINE.—J. S. Stewart, Diamondville, Wyo. In this instance the intention of the inventor is to provide an improved rotary internal combustion engine which is simple and durable in construction, composed of comparatively few parts, and not likely to get out of order, and arranged to utilize the motive agent to the fullest advantage.

Railways and Their Accessories.

RAIL-FASTENER.—D. Ashworth, Wappingers Falls, N. Y. This improvement refers to fasteners for securing railroad rails upon cross ties, and relates more particularly to a device comprising a chair adapted to carry a rail and to rest upon a tie, a holding member extending from the chair to the under part of the tie, and means for securing the member at the under part of the tie.

Pertaining to Vehicles.

VEHICLE-BRAKE.—A. T. Sweeney, Anchorage, Ky. An object here is to provide a brake having means to manually operate the brake and control the same and also to provide means connected with the brake whereby the same may be automatically operated by the action of the team attached to the vehicle in backing, the manually-controlled means and the automatic means being independently operative to apply or release the brake.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

Ornamental Concrete Without Molds. By A. A. Houghton. New York: Norman W. Henley Publishing Company, 1910. 16mo.; 182 pp. Price, $2.

This book treats of the forming of concrete objects in cement by the means of templates. This method is not new, as it involves practically the same methods as used for years in running plaster moldings, center pieces, etc. It has also been explained in detail in "Concrete Pottery and Garden Furniture," by Ralph C. Davison, published by Munn & Co. The use of templates in concrete work is good for certain classes of work, but the field is limited, inasmuch as plain surfaces only can be produced, that is, no bas relief work can be reproduced, such as is possible with either glue or plaster molds. This work contains 124 pages, including 30 full page line drawings and 20 chapters, many of which are only from one to three pages in length. Several of these chapters are superfluous inasmuch as they only repeat dimensions which are clearly shown in the illustrations. The larger portion of the work treats of the various architectural orders rather than of how to produce concrete ornaments. If as much space was devoted to the proper ingredients to use in the concrete mixture and the proper proportions to use in same, as well as to the all important question of curing the casts—points which have not been touched on at all—the work would be of more practical use to those for whom, the author states, it is intended, as there are very few who understand the great importance of the proper mixtures to use or the time and methods to be used for producing a perfectly cured cast. The proofreading could be improved on; also the index is not above reproach, as for example the reference to Crazing, page 23. The circular states: "The process of making ornamental concrete without molds has long been a secret and is now given for the first time in this practical book." This statement is misleading and not warranted by the facts. There is no secret about this process.

Modern Painter's Cyclopedia. By F. Maire. Chicago: Frederick J. Drake & Co., 1910. 16mo.; 465 pp.

Among the subjects treated are: Adulteration of Paint, Blistering of Paint, Brushes, Calcimining, Carriage Painting, China Painting, Colors, Color Harmony, Color Mixing, Color Testing, Exterior Painting, Frescoing, Gilding, Graining, House Painting, Marbling, Oils and Driers, Oil Painting on Glass, Painting a Bath Tub, Painting in Distemper, Paperhanger's Tools, Paper hanging, Pigments, Scenic Painting, Sign Painting, Stains, Staining, Stenciling, Statuary Painting, Turpentine, Varnishes, Varnishing, Water Color Painting, etc.

Legal Notices

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Door and window frame, metal S. C Mouberg 958,663
Door controlling mechanism Voight & Hurd 958,447
Door key guard Myers & Alexander 958,667
Door lock, J Johnson 958,406
Door or window guard E L. Drinkwater 958 481
Drawer cabinet A T Weiss 958,203
Dredging and other similar purposes, submarine device for Fitzgerald & Flood 958 017
Drilling machine Barnes & Vincer 958,604
Drop sidings and matched material, apparatus for laying J L. Norby 958,071
Drying textile and other materials, apparatus for, A. Boley 958,460
Duplicating machine J G Dailey 958,008
Dust collection apparatus for, O M Morse 958,090
Dust pan C W Koertner 958,255
Dye and making same sulfur R Haugwitz 958 640
Dye blue vat, Bauer & Herre 958,404, 958 405
Ear muff I Loewe 958,261
Egg carrier, F O Bulman 958 087
Electric controllers lever check for J Thomas 958,564
Electric light fixtures, swivel joint for G Vossberg 958,448
Electric light hanger W McCaus 958,209
Electric machines armature winding coil for dynamo J D Forrer 957,877
Electric machines coil for dynamo G Chovau 957 800
Electric machines coil for dynamo J D Forrer 957 876
Electric machines, coil for dynamo W T Hensley 957 882
Electric motor C E. Avery 958 354
Electric plug R R Lang 957 801
Electric switch Collins & Hulbert 958 598
Electrical switch J O Heinze Jr 957 953
Elevator safety attachment C K. & H Baumer 958,380
Elevator safety device C R. Pratt 958 670
Engine G L. Borden 958,583
Engine See Blowing engine.
Engraving machine G T Summers 957 912
Envelop, H D Naum 958 521
Envelop A B. Rippetoe 958 543
Envelop and advertising device J G Patton 958 106
Excavator C E. Negley 958,158
Eyeglass mount W G Fay 958,485
Eyeglass mounting G A Bader 957 925
Eyeglass spring A E. Doble 958,236
Fabric supporting reel G T McLeod 957 991
Fanning mill feeding attachment H Dykstra 958,483
Fastener F Hirsh 958,240
Fastener inserting machine W C Stewart 958,040
Fastener inserting machines horn controlling mechanism for W C Stewart 958 036
Fastener puller T G Plant 958,270
Fastening machine metallic M D Phelan 958 083
Fastenings, machine for inserting metallic T G Plant 958,293
Faucet vacuum W Whelan 958 700
Feed bag J H Keiers 958,611
Feed regulator L. C Roberts 958,314
Fence post I F Frasier 958 019
Fence wire, Elwell & Grimm 958,238
File handle T E. Gill 958,032
Filing cabinet L. Senge 958,018
Fire engine portable R H Rice 957 903
Fire escape apparatus, M Fischer 958,385
Fire holes closing device for cellar W C Shepard 958,550
Firearm W H Snyder 958,332
Firearm automatic C H A F L. Ross 958 545
Firearm repeating T C Johnson 958 407
Fireproof partitions, manufacture of D Mowat 958 419
Fireproof shutters baffle for J G Wilson 957 923
Fish and game hook S. B. Lee 958 142
Fishing tackle J M Curtiss 958,221
Float, G Blank 958,581
Flooring sectional metallic J H Striggleman 958 557
Flour C Herendeen 958,486
Flour, making C Hennaden 958 494, 958,493
Fluid compressors construction of rotating wheels for rotary A Huguenin 958,120
Fluid motor elastic J I Shirley 958,583
Flushing tank E Kichman 958,105
Fly screen V J Stratton 958 562
Fly trap, E. R Anderson 958,208
Frame See Door and window frame
Fruit sizer and grader G D. Parker 958,164
Furnace A Fisher 957,873
Furnace arch construction, P Isles 958,130
Furnace for burning blast furnace gases, H R Parson 958 420
Furnaces ignition arch for, W M Duncan 958 779
Game A F Leach 958,250
Game apparatus, W A White 958,342
Game apparatus, card L. A Ely 957 872
Game board T W Spaulding 958 586
Garbage chute and receptacle N W Lowe 958,263
Garbage tank sanitary J Mast 958 414
Garment J H C De Forge 957 877
Garment clasp, J Lemay 958,411
Garment hanger, E. C Clausen 958,369
Gas apparatus, J Fischer 958,243
Gas burner L. De Pasquale 958,108
Gas engine J A. Bash 958,211
Gas fixture, inverted, G. Mock [illegible]
Gas igniter, G. L. Haase, Jr [illegible]
Gas igniting and extinguishing device, electrically controlled H. E. Allen [illegible]
Gas lighting apparatus, H. M. Dixon [illegible]
Gas main, hydraulic, S. Meunier [illegible]
Gas pipe emergency cut-off, M. A. Horan [illegible]
Gases, burning, B S. Parson [illegible]
Gate, Crates & Longbrake [illegible]
Gear, change speed, B C. Griffin [illegible]
Gearing, A. N Adams 958,061
Gearing transmission, J K. Kahns 958,300
Gearing variable speed, J. R. Cox 958,604
Glass drawing furnace, Ralston & Briggs 958,576
Glassware process and apparatus for making, B. Forgo 958,618
Gliding surface for operating in air or water, H Reissner 958,069
Globes or shades in the galleries of electric light gas, and other fittings, means for holding, S. Falk 958,581
Glove, swimming, C P Pearson 958,527
Glue heater alarm, C H. Niemann 958,434
Governor, G B. Nelson 958,159
Governor, centrifugal, F W Bentley 957,861
Governor centrifugal Junggren & Bentley 957,889
Grain picking and cleaning machine, J A. Cowan 958,097
Grain shocker, J G Stewart 958,190
Gravel from sand, etc., apparatus for separating, Torjusen & Elstrom 958,563
Grinding and crushing mill, F H. & F. H. Brown 958,075
Grinding and sharpening machine, knife, W C Stewart 958,082
Grinding machine feeding mechanism C M Conradson 957 935, 957 936
Grinding machine knife W C Stewart 958,030
Grout mixer W McIlvrid 958,421
Gun differential recoil, K. Haussner 958 119
Gun firing mechanism Meigs & Hummar 958 000
Gun sight protector W Langstroth 958 655
Gun training and elevating mechanism Meigs & Jakobsson 958 515
Gun, trick, G P. Biggs 958,712
Gun, trick water R. De Moulin 958,711
Guns feed apparatus for automatic L. B. Benet 958,078
Hame fastener E J Jones 958,354
Hammer and puller, track S. L. Young 957,924
Hammer for tinsmiths etc J O Charpentier 958,505
Hammer support pneumatic H Neville 958,689
Handle See File handle
Handle, J T Hammond 958,114
Harrow, Warne & McLean 958,300
Harvester cutting mechanism corn, L. R. Parsons 958,165
Harvester, grain D W Smith 958,331
Hat cleaning machine, C S. Schwarz 958,527
Hat holder G Auburton 958,070
Hat pin attachment J R Jameson 958 404
Hay tedder B F Lutz 958,514
Headlight adjuster locomotive O. B. McCoy 958,522
Heating system water J F Hickerson 958,121
Heating utensil K L. Comes 958 227
Heel breasting machine G T McLeod 957,986
Heel breasting machine, boot and shoe, M D Phelan 958,005
Heel burnishing machine O. R. Hood 957 958
Heel compressor M D Phelan 958,001
Heel edge liner G T McLeod 957,993
Heel nailing machine F Woodward 958,058
Heel shaver M D Phelan 958,006
Heel shaving machines counter guard for, F F Eno 957 943
Heeling machine E. Woodward 958,058
Heeling machine T G Plant 958 282, 958 292
Heeling machine attachment T G Plant 958 281
Heeling machine top lift holder W C Stewart 958 041
Heeling machine work holder W C Stewart 958 038
Heeling machine work holder T G Plant 958,303
Heeling machine work support T G Plant 958 300
Helical rolls making C B. Lockwood 958,141
Hog scraper M Deihl 958,101
Hoisting apparatus T O Werner 958,049
Hoisting buckets means for turning A. C Johnston 958,646
Hoisting device F O Carvin 957 865
Hoisting device G F Koenig 957 980
Hook. See Fish and game hook
Hook and eye F M Cowles 958,369
Hoop sizing and clamping device L. Gibbs 958 390
Horseshoe attachment, H Huth 957 884
Horseshoe attachment Rubrecht & Dean 958,547
Horseshoe cushion padded W N Gowing 958,629
Hose braided H Z. Cobb 957,967
Hose coupling lock, H M Robertson 958 437, 958 438
Hose holder T Boeson 957 930
Hose supporter B Ortell 958,425
Hotel lock Arens & Teich 958,352
Humidifier R I Smith 958 535
Hydrant, A A. Bonnett 958 079
Hydrocarbon burner E. G Wickersham 958,344
Hydrocarbon burner Clark & Nequette 958 692
Ice making machine C Wagner 958 683
Ice saw K K Witt 958,684
Illuminating device for burning wax P Destefani 958 235
Incandescent light R D Cody 958 094
Incinerating plant Price & Bennett 958,308
Index clasp vertical file C J Whipple 958 050
Ink well, T E. McNulty 958,098
Insectifuge holder P Pollard 958 078
Insole edge trimmer W H Hooper 957 980
Insole for boots and shoes T J Ryan 958 013
Insole reinforcing strips machine for cutting and slitting G T McLeod 957 990
Insole tempering machine W H Hooper 957 961
Insoles of boots and shoes, machine for treating W H Hooper 957 959
Insulating covering for cables P Torchio 958 046
Internal combustion motor C. A & O W Hult 957,963
Ironing and dressing machine, T G Plant 958,304
Ironing board R. M Bain 958,071
Irrigating cutter C Diehl 958 470
Jack for slugging and other machines, W C Stewart 958,031
Joint W Pence 958 276
Joint coupling lock J K Bolger 958,088
Kelr Butler & Flick 958,591
Key seating machine W Billing 958 091
Lamp, alcohol-vapor A Rector 958,810
Lamp and similar device electric tube D. M Moore 957 983
Lamp burner F Bow 958,378
Lamp carbureting Torchebeuf & de Lamberty 958,045
Lamp shade holder A J Morgan 958,095
Lamp socket cap electric G W Goodridge 958,625, 958,626
Lamp socket electric R B Benjamin 958,216
Lamps, regenerating carbon filament electric incandescent R. A Kruger 958,658
Lanterns, view dissolver for magic O C Currie 958,870
Lap robe A G Frankenhoff 958 617
Last expansible foot, J. E Leavitt 957 975
Lasting device auxiliary, T G Plant 958,286
Lasting machine P R. Glass 957 940
Lasting machine T G Plant 958 290
Lasting machine bed F Holbrook 957,882
Lasting machine bed, T G Plant 958,291
Lasting machines, hold-down for N C Bohr 958,088
Lasting machines, pincer mechanism for T H Seely 958,017
Lasting machines, pincer or gripper mechanism for, T. H. Seely 958,187
Latch for end gates of mining cars I R Beaver 958,075
Latch mechanism for emergency doors, Arens & Teich 958,352
Latch mechanism for split stocks and dies, R H. Leach 958,511
Lathe, H R. Greig 958,631
Lathe and other tool holder for cutting, shaping, and screwing purposes, H R. Land 958,654
Lathe dog, J. W. Fawcett [illegible]
Lathe, stoneworking, W F Meyers 957,970
Lawn rake, A J Platt 957,900
Laying and leveling machine, T. G. Plant [illegible]
Leather skiving machine, G. A. Martin [illegible]
Leather working die, E. G. Schumann [illegible]
Level, O. E. Anderson [illegible]
Level and grading instrument, combined, J. Hedberg 958,[illegible]
Light. See Incandescent light.
Light holder detachable and portable, W H. Sackman 958,[illegible]
Lighting fixtures, shade and reflector support for, W. C Hine 957,[illegible]
Lightning arrester, H. O. Wirt 958,[illegible]
Line casting machine, J R. Rogers 958,[illegible]
Line casting machines, matrix for, H. M. Bedell 958,078
Line holder, T Peterson 958,169
Line spacing mechanism, J. Raber 958,178
Linotype machine attachment, C G Pickett 958,[illegible]
Liquid fuel tank, J A Steinmetz 958,033
Liquids from solids, separating, H. G Nichols 958,373
Liquids, means for separating contaminated ores or other solid matter from A. J. Arbuckle 958,[illegible]
Loading and unloading device, O. R. Hoake [illegible]
Lock, W Cox [illegible]
Lock, J A Chambless [illegible]
Lock strike, T B. Stevens [illegible]
Locking device for windows, transoms, or the like, R. H. Flora 958,[illegible]
Locomotive, articulated compound Mellin & Jones 958,[illegible]
Loom, narrow ware or ribbon, E. R. Holmes 958,[illegible]
Loom shuttle binder A. A. Gordon 958,[illegible]
Loom take-up motion, W H Clegg 958,[illegible]
Looms, drop shuttle box mechanism for, E. H Ballou 958,[illegible]
Lubricant retainer, J R. Tholand 958,[illegible]
Mail bag catcher, J Rangstad 958,[illegible]
Mail bag catcher and deliverer J Yates 958,[illegible]
Manifolding device, E J Toussignant 958,[illegible]
Marble supporting transportation device T J Little, Jr 958,[illegible]
Marker land P A. Ulrich 958,[illegible]
Match box B. W Bock 958,[illegible]
Match holder H. G Blankenhagen 958,[illegible]
Match safe L. Hildreth 958,12[illegible]
Mattress, H Laurila 957,[illegible]
Measuring and registering the oscillations of vibrating bodies, such as marine vessels, airships, railway vehicles, and the like apparatus for P Ross 957,908
Measuring instrument, electrical F W Roller 958,420
Megaphone, L. B. Purcell 958,680
Metal cutting machine E G. Todt 958,196, 958,197
Metal furnace A Fisher 958,384
Metal sawing machine, W L. Field 958 638
Meter See Water meter
Meters, shunt for electric R C Laughler 958,308
Milking machine, K A. Ahlborn 958,068
Milking receptacle J N Horne 958,399
Mills sieve for drum G. Zaruiko 958,348
Milling machine F O Farwell 958 249
Mining machine J C Hirst 957 957
Miter box R Dunne 957 871
Miter joint for tubes, Rogers & Vallone 958,316
Mitt, baseball J Hartman 958,117
Mixing machine, G Kirich 958,028
Moistener, M A Metzner 958,149
Molding machine E. D. Misner 958,039
Motor control apparatus A E. Stevens 958 442
Motor controlling device L. S. Chapman 958,363
Motor controlling device G T Kagar 958,390
Motor safety attachment hydraulic O J Henry Jr 958,120
Motor starting switch electric E. Garskie 957 943
Mowing machine belt tapping attachment R. E. Murphy 957 896
Music sheets spool for W F Bayer 958,214
Musical instrument, automatic C A. Rohrbacher 958,318
Musical instruments, keyboard for keyed A Schuls 958,186
Mustard grinding mill I Oehmig 957 997
Nail assorting and delivering mechanism W C Stewart 958,037, 958 039
Nozzle steam J W Stillwell 958 444
Nut lock H J Bond 957,931
Nut wagon G Lochhead 958,262
Oar lock adjustable E R Matson 958,704
Oil burner C W Seivert 958,330
Oil burning furnace C C. Phipps 958 433
Oil cup closure, E. J & W L. Nabin 957 994
Oil distributing apparatus C P Price 958,434
Orchard heater R J Meyer 958,151
Ordnance firing mechanism for, Holmstrom & Mascall 958,642
Ore, furnace dust waste metal waste iron etc, briquetting fines of, M Glass, 958 023, 958,700, 958,701
Ornamental articles, producing, W L. Hearn 958,641
Outside marker, W C Stewart 958,033
Packing for annealing and other like apparatus, fusible, W R Kinnear 958 409
Packing for cylinder molds, H Parker 958,273
Pan. See Dust pan.
Paper and grooving same, Ramage & Shaw 958,174
Paper cutting machines, cutting stick for B. M Helm 958 405
Paper cutting shears, A Worcester 958,453
Paper making machine, E. N Hamlin 958,113
Paper pulp engines, roll bar for, O I Ware 958,708
Paste applying apparatus for can ends, A. Johnson 957 967
Paste box O Dreher 958 480
Pavements, making J Y McClintock 957 985
Penholder fountain H B. Brewington 958 472
Perambulator, convertible J Ford 957 874
Perambulator folding, F A Nauls 958,423
Pianos, coin controlled actuating mechanism for automatic A J Hobart 958 125
Picture film motion A I Clawson 958,367
Piece goods, apparatus for piling J W. Banks 958,579
Pillow J L. Kennedy 958,502
Pin J H Reed 958,811
Pin safety catch, S. J McMillen 958,423
Pipe O A. Lord 958,264
Pipe support and clamp, D Williams 958 052
Piston A. L. Mowry 957 994
Planetarium A Laing 958,139
Planter corn or cotton C Wilks 958 204
Plow, motor, J J Middlebrook 957 979
Plow sulky H P Curtright 958,096
Plows, adjustable beam and frame for sulky and gang H S. Busby 958,091
Plows, potato digging attachment for, F Day 958,603
Pneumatic despatch tube apparatus, carrier for, M L. Emerson 958,240
Pole anchor, K. T Hovrud 958,127
Post binder, B W Murphy 957 995
Posts, construction of H. C Stewart 958,[illegible]
Potato digger, J S. Hoagland 958,[illegible]
Power plant hydro-electric, F W Holland 958,[illegible]
Press. See Baling press.
Press, J Thomson 957,916
Printing machine, rotary Evans & Wiebmann 958,484
Printing press, J. Thomson 957,917
Printing press, F. Meisel 958,302, 958,[illegible]
Projection apparatus, W L. Patterson 957,[illegible]
Propeller, G Gaya 958,[illegible]
Propeller M Cooney 958,[illegible]
Propelling means for vessels, L. Sibole 958,[illegible]
Protective device R. H. Manson 957,[illegible]
Pull socket F W, Healy 958,[illegible]
Pulley, power transmitting W A. Owen 958,[illegible]
Pulley safety, P. J. A. Brunner 958,[illegible]
Pulleys, crane for clothes line, L. F. Becker 958,[illegible]
Pulp and analogous materials, machine for forming articles from, A. Stackleton 958,[illegible]
Pump, rotary J R. Kinney 958,[illegible]
Pump, vacuum, J. T. Wilkin 958,[illegible]
Pumping systems, regulator for gas, R. Schulte 958,[illegible]
Punching machine, J B Thompson 957,[illegible]
Quick-acting wrench, W E. Brown 957,[illegible]
Radiators, valve attachment for, W. L. Walter 958,[illegible]
Rail, J. C. Getty [illegible]
Rail bond, C. R. [illegible] [illegible]
Rail chair and coupling, Evans & [illegible] [illegible]
Rail joint, C. E. [illegible] [illegible]
Rail joint, C. J. Mills [illegible]
Rail joint, W. E. Mills [illegible]

The Latest Mallet Freight Engine.

(Concluded from page 436.)

miles. On these divisions there is a heavy movement of freight traffic, consisting mostly of loaded coal trains. The grade conditions on this portion of the road are severe and sharp, curves are numerous. Against northbound traffic, in which direction practically all the movement of loaded freight trains takes place, there is a six mile grade of 1.36 per cent from Carbondale to Forest City. From the latter point to Ararat, the summit of the rise, a distance of 14 miles the road is on a grade averaging 0.81 per cent. Going down the other side of the mountain, it is practically a continuous grade of 51.7 feet per mile for 75 miles into Oneonta.

Hitherto the freight traffic on this division has been handled by consolidation locomotives, having a theoretical maximum tractive power of 49,690 pounds. A single engine of this class can very satisfactorily handle a 2,600-ton train from Ararat to Oneonta, but it requires the assistance of two locomotives of the same class, as pushers, to haul this load up the 20-mile grade to Ararat, at which point the pushers cut loose.

With a view to reducing the operating expenses of the division and facilitating the movement of trains, the officials of the Delaware & Hudson Company decided to investigate the efficiency of the Mallet type locomotives for this service. It was their aim to secure a pusher engine of this type of sufficient power to move the maximum train load up the hill with two engines instead of three.

In the fall of last year one of the heavy Mallet engines built by the American Locomotive Company for the Erie Railroad was borrowed, and put into pusher service on the 20-mile Ararat grade. A number of test runs were made which proved that a single Erie Mallet engine easily did the work of two of their Class E-5 consolidation locomotives. Following these tests the six Mallet engines were ordered from the American Locomotive Company, and put into this service.

These engines are of a straightforward design, embodying but slight modifications from the designs of previous locomotives of this type of lesser weight and power constructed by these builders. With the boiler pressure of 220 pounds and driving wheels 51 inches in diameter, the theoretical maximum tractive power working compound calculated by the company's formula is 105,000 pounds.

As this formula, which is applicable only to articulated locomotives built by this company, is based on the results obtained from a large number of indicator cars, taken under various service conditions, it is found that the tractive power thus calculated represents very accurately the actual power that the locomotive can develop at a piston speed of not over 250 feet per minute.

With the company's system of compounding the normal maximum tractive power working compound, can be increased about 20 per cent by changing the engine into simple. The maximum tractive power of these engines working simple is thus 126,000 pounds.

New Two-Cycle Motors.

(Continued from page 444.)

compressed air which would then be furnished by chamber *B* to receiver *D*. It is well understood that the high velocity produced by air under pressure is far more efficient in atomizing liquids than the comparatively low velocity produced by suction. This type of engine should produce twice the power of a four-cycle engine of the same size and speed, and we are informed that tests now being made show this to be the case.

Another engine using a differential piston, but in an entirely different way is the Shortt Motor. This engine compresses air only in the crank case. Unlike the others here described it does not admit this air through a port opened

(Concluded on page 450.)

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. In every case it is necessary to give the number of the inquiry. Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

BUSINESS OPPORTUNITIES

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres. The Nat'l Co-Op. Real Estate Co., Suite [illegible], Marden Building, Washington, D. C.

Inquiry No. 9018. For manufacturers of "Wydt's Electro Catalytic Sparking Plug."

FIFTY DOLLARS AND UP weekly made by any live hustling agent selling Thurman Vacuum Cleaners, "The standard of the world." Not toys but machines of the highest grade. Every sale means "an agent working for you." You can build up a permanent paying business. Write for agency proposition. Gen'l Compressed Air & Vacuum Mach'y Co. [illegible] N. Taylor Ave., St. Louis, Mo.

Inquiry No. 9007. Wanted the manufacturers of the Van Winkle, Woods & Sons, and the Weber power meters.

HELP WANTED

GET A BETTER PLACE.—Uncle Sam is best employer; pay is high and sure; hours short; places permanent; promotions regular; vacations with pay; thousands of vacancies every month; all kinds of pleasant work everywhere; no lay offs; no pull needed; common education sufficient; find out how you can have a position guaranteed you by asking today for B. R. 40. Free. Earl Hopkins, Washington, D. C.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

FOR SALE

FOR SALE.—Interest or control in manufacturing business. Exceptional opportunity for manager or instrument maker. Control, Box 773, N. Y.

Inquiry No. 9019.—Wanted machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

WILLIAMS-MARLE alcohol radiant projector lantern, with 12 mantles, cost $75.00, price $25.00; 67 astronomical slides with carrying case for 50, cost $34.75, price $17. For sale separately or whole outfit $40, all absolutely new. 108 Wall St., Room 45, Phone 1546 John.

Inquiry No. 9023.—Wanted to buy silk machines from re-reeling, twisting, doubling, to the final process of making it into clothes.

PATENTS FOR SALE

PATENT No. [illegible]. An improved vehicle wheel, intended for automobile, or to take the place of pneumatic tires. John H. Scott, 63 Prince St., New York City.

Inquiry No. 9029.—Wanted catalogues and all information on machinery for braiding straw in manufacturing straw hats.

MUNT SHIL L PATENT (951,377) Recording Target. Army, National Guard, shooting clubs, colleges, police, etc. 25,000. U. S. $[illegible] profit each. Great hit. Particulars J. J. Metzger, Public Square, Cleveland, O.

Inquiry No. 9038.—Wanted, the address of the Chipman Electric Purifying Co.

THERMOS BOTTLE REFRIGERATOR. Pat. March 1st, 1910, No. 951,058 covers the idea broadly of a refrigerator each of whose sides is cast in one piece of glass, porcelain or aluminum (porcelain covered), and hermetically sealed to form independent vacuum chambers of the nature of the Thermos bottle. Royalty preferred. A. K. Cross, 8 Beacon Street, Room 55, Boston, Mass.

Inquiry No. 9060.—Wanted to buy machinery to manufacture seed corn racks.

LISTS OF MANUFACTURERS

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9075.—Wanted to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

SALE AND EXCHANGE

FOR SALE.—Engine lathe. Our regular $75.00 lathe complete with a face plate, two centers, wrenches and a full set of change gears to cut all size threads. Price only $45.00. L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9076.—Wanted the address of parties in Canada who could make a safety razor.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9077. Wanted the address of manufacturers that make small articles of wood, such as checker boards, etc.

MISCELLANEOUS.

STAR Sphere of Light Clock. For particulars address William Rose.

Inquiry No. 9078.—Wanted the address of manufacturers of sewer pipe made of fiber and asphaltum, suitable for laboratory use.

Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

Inquiry No. 9083. Wanted, the address of firms manufacturing small beer brewing plants, from 10 to 100 gallons a day.

Inquiry No. 9092.—Wanted the address of some firms who manufacture permanent lamp wicks.

Inquiry No. 9091. Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9096. Wanted the address of manufacturers of spiral welded pipe possessing great strength.

Inquiry No. 9097. Wanted address of makers of impulse water wheels.

Inquiry No. 9098.—Wanted name and address of the manufacturers of the osculiser.

Inquiry No. 9099.—Wanted address of manufacturers of machinery for making wire cables.

Inquiry No. 9101.—Wanted, addresses of manufacturers of a dip or magnetic needle, for exploring for gold ore.

Inquiry No. 9107.—Wanted, addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9112.—Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114.—Wanted name and address of manufacturer of the Auto Lantern Globe. Fits all lanterns.

Inquiry No. 9116.—Wanted a machine for making pen nibs, similar to Wm. Mitchell's "J" & J. nibs and Waverly nibs.

Inquiry No. 9117.—Wanted names and addresses of the manufacturers of pedometers.

Inquiry No. 9118.—Wanted, a muffler for a gasoline engine, built upon the principle of the Maxim silencer, recently brought out for use on rifles.

Inquiry No. 9119.—Wanted, name and address of the manufacturer of Barlin bullet-proof cloth.

Inquiry No. 9120.—Wanted, the address of the Ideal Fuel Feeder Co.

Inquiry No. 9121.—Wanted, manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9124.—Wanted, name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9127.—Wanted, address of L. Dernigny, manufacturer of a family ice machine for $[illegible].

Inquiry No. 9128. Wanted, manufacturers of a gasoline traction engine with a hoisting attachment; in other words, the machine will be used as a portable stump puller to pull sassafras roots, used in making oil of sassafras.

Inquiry No. 9134.—Wanted, a small hydraulic motor, capable of giving about one horse power with a water power of [illegible] lbs. per square inch.

Inquiry No. 9135.—Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted, the address of manufacturers of machines capable of forming a number (12 or more) of pieces of paste about [illegible] mm. x [illegible] mm. x 6 mm., made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 4 mm. The process could be somewhat similar to biscuit making.

Inquiry No. 9139.—Wanted, the name and address of some manufacturer of a coffee mill run by water motor.

Inquiry No. 9140.—Wanted, manufacturers of disc records for gramaphones that use a sapphire point instead of a steel needle.

Inquiry No. 9142.—Wanted name and address of the manufacturers of an air mattress.

Inquiry No. 9144.—Wanted, manufacturers of machinery for making soda water tubes, commonly known as straws.

Inquiry No. 9145. Wanted to buy machinery to load blasting caps or detonators.

Inquiry No. 9149.—Wanted, manufacturers of machinery for roasting coffee for small and large industries.

Inquiry No. 9150.—Wanted, manufacturers of machinery for the manufacture of French heels for ladies' shoes.

Inquiry No. 9152.—Wanted, the address of the Graham Safety Lamp Filler and Ventilator.

Inquiry No. 9153.—Wanted, name and address of manufacturers of a knotless clothes line.

Inquiry No. 9154. Wanted name and manufacturers of a newspaper vending machine.

Inquiry No. 9155. Wanted, the address of manufacturers of an electric milking machine.

Inquiry No. 9156.—Wanted the name and address of manufacturers of a rust proof oil, known as Caoutchouc Oil.

Inquiry No. 9157.—Wanted, manufacturers of peanut shelling and cleaning machinery.

Inquiry No. 9158.—Wanted, manufacturers of a material in sheets to take the place of vulcanized fibre for novelty work.

Inquiry No. 9159.—Wanted, manufacturers of any successful substitute for hard rubber.

Inquiry No. 9161.—Wanted, a machine that will grind oranges, pulp and skin into a smooth liquid or cream.

Inquiry No. 9162.—Wanted, addresses of shirt makers in Manhattan, who will make a few shirts of special design.

Inquiry No. 9163.—Wanted, manufacturers of a cradle worked by clock work.

(Concluded from page 440.)

by the piston, but uses instead a valve which is vacuum actuated. The partial vacuum to operate this valve is formed above the larger differential piston F. When this piston reaches the bottom of its stroke it uncovers a port G, through which air enters and breaks the vacuum, whereupon the valve instantly closes. The fuel is fed from a pressure tank through a needle valve, and is delivered at the seat of the main inlet valve. As the pressure in this tank is greater than that of the inrushing air from the crank case, it forces the fuel into the cylinder against the air pressure. It is claimed that the time the valve is open will vary with the speed of the engine so as to let in the right amount of fuel. The annular chamber of the piston is used only to produce a partial vacuum which operates the main valve. This engine should get sufficient air for clearing the cylinder on account of the enlarged piston end and should be able to produce considerably more power than the usual two-cycle motor.

Prof. S. P. Thomas recently stated before the Royal Society that he had succeeded in producing a physiological effect by means of magnetism. A coil of copper wire was made 9 inches in diameter and 8 inches long, containing 32 turns. Through this an alternating current of 60 cycles was passed, with a maximum flow of 180 amperes, giving 5,760 ampere turns. In a dark room, when an observer placed his head in the mouth of the coil, he could see a faint bluish light, which was not steady but appeared to flicker considerably. This could be observed

[illegible] with the eyes closed. When the experiment was tried in broad daylight with the eyes open, this flickering sensation still persisted. The blue light, which was visible only in the dark, appeared to be brighter near the wire than in the center.

How to Act in Case of Fire.

(Concluded from page 441)

dredging the part thickly with flour—if the skin is not broken—and not disturbing it for some time.

Any vegetable oil—such as salad, sweet, or linseed—may be used with advantage, a rag being soaked with it and used to cover the wound. A very good application is made by mixing equal parts of linseed oil and lime water, forming "carron oil."

Finally, it cannot be too strongly impressed that all clothing covering a burn must be removed with the utmost care. Never try to withdraw the injured limb, but cut the clothing away—in small pieces, if necessary—so that the injured surface may not be more damaged Never hold a burn in front of the fire, according to the popular practice, this only increases the injury Have your oil or other application ready for immediate use as soon as the clothing has been removed

Fontenelle's Theory of Comets.

The idea of comparing comets to great glass lenses, which concentrate the sun's rays into luminous cones which appear as the comets' tails, is so natural that its origin cannot be traced It was indicated by the philosopher Seneca, about the commencement of the Christian era, but it has been abandoned in accordance with the example of Kepler, who after first embracing this doctrine with enthusiasm, renounced it on discovering that a large comet, which he had occasion to observe, possessed a curved tail. The impossibility of explaining this phenomenon, at a time when it was not known that light consumes a measurable time in traversing interplanetary space caused Kepler to abandon the idea. The celebrated Fontenelle, regardless of this objection, took up and expounded the lenticular theory of comets in an admirable manner in his 'Plurality of Worlds." The coming of Halley's and several other comets has caused Wilfrid de Fonvielle to recall the attention of the French Academy to Fontenelle's theory and the arguments which may be brought forward in its favor At present, on the coast of every civilized country, phenomena similar to those to which Fontenelle attributed the formation of the tails of comets, are produced by the lanterns of lighthouses. The dust which is suspended in the atmosphere is illuminated by the beam of light as Fontenelle supposed the cosmical dust to be illuminated by the concentrated beam of sunlight behind the lenticular comet. De Fonvielle shows that this theory explains the individual peculiarities of comets, and is confirmed by observations made recently at the Paris and Greenwich observatories For example, a division of the tail is explained by assuming that the cloud of cosmical dust is not continuous, but intermittent, and the occasional sudden appearance of bright points indicates the existence of a reflecting body of considerable size. In a word, all the variations which are observed in meteoric showers might on this theory be expected to occur in the tails of comets. The evidence of the spectroscope and the freaks of Morehouse's and Halley's comets are against this lenticular theory

Engineers of the United States Geological Survey estimate the annual damage by floods in the United States at $100,000,000. It is too early, perhaps, to undertake to prevent or to diminish this immense loss, but its very magnitude invites a serious study of means of prevention, and the recent misfortune of France may lead to practical work that will serve as an object lesson to America.

(Concluded from page 449)

Telephone system and apparatus, A K Andriano 958,0[illegible]
Telephone system intercommunicating L E. Corwin 957,969
Telephonic transmitter P Stragiotti 958,561
Temperature regulator, thermostatic D O Nation 958 157
Tent shelter N D Anderson 958 086
Threshing machine frame J B. Bartholomew 958 217
Threshold illuminated C B Ricketts 958,842
Ticket holder, car Baker & French 958 577
Tie plate W Mehus 958 271
Tile mold F Gorman 958 028
Time computer automatic R H Bousley 958 584
Tipping furnace mixer etc J L Killingworth 958 503
Tire, W B Connell 958 098
Tire protector J Wilmes 958 068
Tire wrapping and unwrapping machine N E Haber 958,309
Tobacco pipe H Willis 957 922
Tobacco shield J H Scott 958 015
Tobacco smoking pipe W E Hooker 958 [illegible]
Toilet article P H Watson 958,[illegible]
Tongs, A D Carroll 958,[illegible]
Tool bag T J Youngiove 958,347
Tool frame A Neubert 957 997
Toothpick J G Straub 958,038
Torpedo tube attachment J Kimbrell 958,050
Tracker bar G P Brand 958 470
Traction engine Hinshaw & Wade 958 123
Train stopping mechanism J F Webb Jr 958 047
Transmission apparatus J A Raab 958 212
Transmitter mounting N Pedersen 958 107
Trap See Animal trap
Tread plug non-slipping J L Campbell 958 364
Treadle foot F Bourquin 957 963
Treeing machine W H Hooper 957 962, 957 963
Treeing machine boot W H Hooper 957 964
Trees reinforcing W F Davey 957 940 958 244 958 478
Trombone slide H N White 958 061
Trousers stretcher R P Baird 958 770
Truck construction for cars S P Bush 958 362
Truck side frame A O Buckius Jr 958 474
Truck side frame F M Richardson 958 [illegible]
Truck side frame car J H Baker 958 462
Truss T F Martin 958 207
Tube cleaner F F Hauer 958 118
Tube forming and cutting off machine C F Jenkins 957 968
Tunnel W Butler 958 [illegible]
Turbine R C Frohlich 957 944
Turbine, C A Parsons 958 430
Turbine blades means for securing Funder & Fritz 958 [illegible]
Turbine elastic fluid E Thompson 957 915
Turbine governing mechanism R H Rice 957 [illegible]
Turbine governing mechanism elastic fluid W Kieser 957 890 957 [illegible]
Turbine governing mechanism elastic fluid I Olivier 957 [illegible]
Turbine shafts packing for elastic fluid O Junggren 957 887
Turbine water F A Nilsen 958 079
Turbines and pumps means for balancing W H Eyermann 958 012
Turbo unipolar generator O Schulz 958 081
Type and type bars making F H Richards 958 416
Type bar F H Richards 958,415
Type distributing apparatus R Dacheux 958 600
Typewriter ribbon box C M Crider 958 21[illegible]
Typewriting machine S Nielsen 957 995
Typewriting machine C B Yaw 958,078
Typewriting machine E B Hess 958 702
Typewriting machine carriages ball bearing for F B Hess 958 498
Typewriting machine ribbon mechanism C Gabrielson 958,798
Types and type bars machine for making F H Richards 957 984
Umbrella receptacle for cars M Coleman 958 006
Umbrella tip notcher F Wetterroth 958 341
Undergarment C B Marsville 957 895
Universal joint incased C W Spicer 958 023
Upholstered chair J C A Rale 958 [illegible]
Urea of the anthraquinone series and making same Schmidt & Kranzlein 958 [illegible]
Valve F Snow 958 [illegible]
Valve D F Washington 958 451
Valve J W McCown 958 [illegible]
Valve and meter combination F J Moore 958 081
Valve automatic gas Hrivnak & Baton 958 [illegible]
Valve brake W K Rankin 958,176
Valve for pneumatic sanders locomotive J H Hanlon 958 [illegible]
Valve mechanism for water closets F C Anderson 958 [illegible]
Valve regulating A M Allen 958 [illegible]
Valve rotary R W Hindan 958 [illegible]
Valve siphon J T Burns 958 [illegible]
Vapor apparatus controlling device P H Thomas 958 195
Vapor apparatus starting device P H Thomas 958 [illegible]
Vapor rectifier system C M Green 958 [illegible]
Vehicle motor F H Johnson 958 [illegible]
Vehicle motor J J Middleton 958 [illegible]
Vehicle seat adjustable R G Leslie 958 416
Vehicle shock absorber T Lea 958 [illegible]
Vehicle spring arrangement J Rosemeyer 958 514
Vehicle wheel C D Anderson 958 [illegible]
Vehicle wheel M W Rosenshine 958 4[illegible]
Veil automobile J A Siegel 958 120
Vending machine J F Kreuss 957 971
Vending machine R F Downey 958 237
Vending machine centering mechanism for rotary F S Hagen 958 [illegible]
Vending machine cigar H R Stouder 958 [illegible]
Vessels device for determining the metacentric height of Tate & Cassell 958 192
Vest corner stiffener C D Clements 958 083
Vibrator electric S W Moss 957 982
Vibrator for induction coils H L Lawton 958,[illegible]
Violin J A Martin 958 148
Vise bench J H Long 958 [illegible] 958 [illegible]
Wall heat insulating C J Coleman 958 [illegible]
Washbench J I Harrington 957 [illegible]
Washing machine gearing H I Staley 958 [illegible]
Washing machine gearing O H Watkins 958 [illegible]
Water gage F Baker 958 [illegible]
Water heater W T Hicks 958 [illegible]
Water heater instantaneous T Tache 958 [illegible]
Water meter O F Kadow 958 [illegible]
Water motor H W Meager 958 [illegible]
Water motor J N Hardy 958 [illegible]
Watering trough T C Johnson 958 [illegible]
Wave or current motor J L Bennett 958,407
Weed hook sectional H I Woodin 958 065
Weighing device spring scale H B Hufferberger 958 172
Well casing repairing tool J C Mettler 958 [illegible]
Well mechanism M F Lavin 957 974
Well strainer oil and water H R Decker 958 100
Welt laying and attaching machine G T McLeod 957 987
Wheel See Vehicle wheel
Wheels in divided metallic molds apparatus for producing C Grunwald 958 035
Whiffletree J J Boulting 958 069
Window A F Clark 958 506
Window frame W B Harris 957 881
Window screen P Ried 957 909
Writing machine F B Hess 958 497
X ray tube H Green 958 488
Yoke center neck G A Lambert 958 141

A printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863 will be furnished from this office for 10 cents provided the name and number of the patent desired and the date be given. Address Munn & Co Inc 361 Broadway New York

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co. Inc 361 Broadway New York

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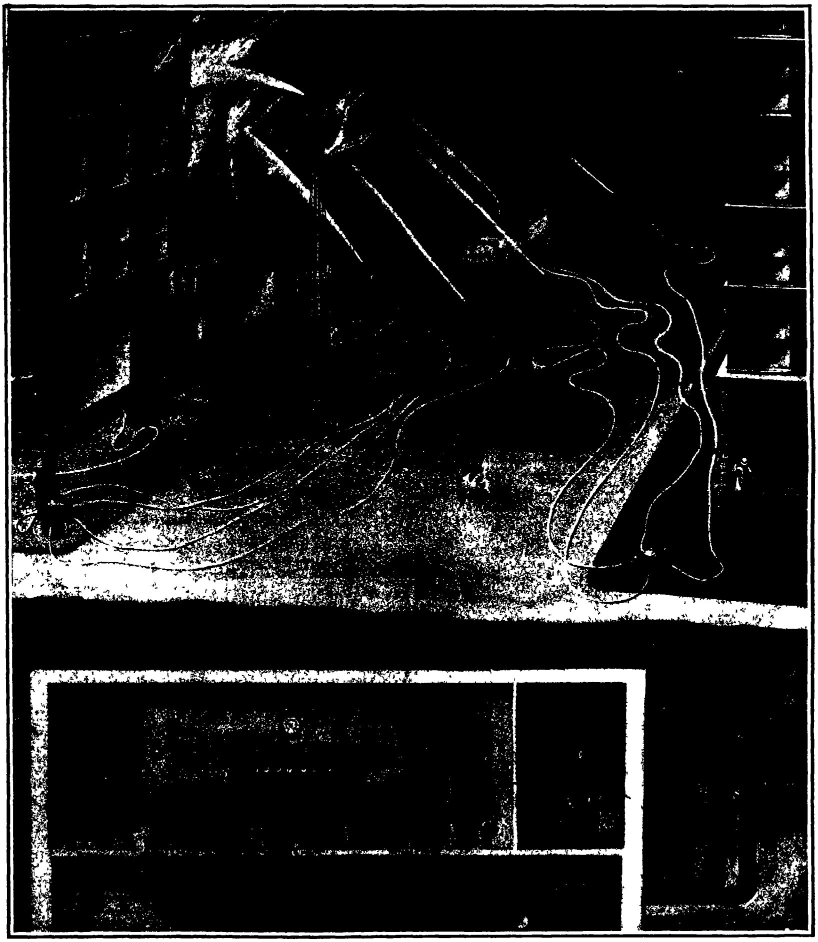

Notice of a fire comes to the operator at telephone (see view of pumping station), who instructs engine room crew by means of marine telegraph. The engineer at switchboard starts electric pumps which draw water from the water mains or the river, and deliver it through mains to the district in which fire rages. The chief at the fire is in touch with station operator through special telephone wire.

FIRE FIGHTING WITHOUT FIRE ENGINES.—[See page 458.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

WHAT WILL THE RAISING OF THE "MAINE" DISCLOSE?

THE action of Congress in passing a bill making a preliminary appropriation for the work of raising the wreck of the "Maine" is, for several reasons, highly commendable. Chief among these is the opportunity which will be afforded to give decent burial in the national cemetery at Arlington to the bodies of the unfortunate men, who were carried down in the wreck of the ship, and have remained entombed for the past twelve years. Look at it whatever way we will, the fact that no effort has been made to recover these bodies carries with it a certain uncomfortable aspect of neglect, and the nation owes it to the memory of the dead, to the sensibilities of their surviving relatives, and lastly to its own dignity and self respect, to recover what may be left of the mortal part of these brave seamen, and give them decent interment with proper military honors.

Second only in importance to the above considerations are those which affect the sensibilities, and particularly the sense of honor, of a European power with whom we are at present and hope ever to be, on terms of friendly understanding, for it is a fact that the Spanish government felt very keenly the implication that the destruction of the "Maine" was brought about by Spanish agency—an implication which, though not expressed, yet necessarily followed from the finding of our Naval Board of Inquiry, which concluded that the "Maine" was destroyed not from without. "In the opinion of the Court," says the report, "this effect could have been produced only by the explosion of a mine situated under the bottom of the ship at about frame 18 and somewhat on the port side of the ship."

Now, although our Navy Department did not then and does not now, believe that the Spanish officials were in any way concerned in the disaster, attributing the explosion to the hatred of fanatics, it is doubtful if this opinion was shared, or is even yet held, by the majority of people in the United States. Therefore the raising of the "Maine" will be well worth all the trouble and cost it will entail, if the thorough physical examination of the wreck which can then be made, brings to light clear evidence that the explosion was due to internal causes, that is to say, to the spontaneous and therefore accidental combustion of the explosives contained in the forward magazines. This latter was the explanation offered by the Spanish Naval Board which examined the wreck at the time of the disaster, and it is significant that it received credence not only among naval experts abroad, and especially those of England, whose attitude was markedly friendly at the time, but also among not a small percentage of the officers of our own navy.

It would be a "consummation devoutly to be wished" if the raising of the wreck should afford ample evidence or even a strong presumption, that the "Maine" was wrecked by spontaneous explosion in the magazines. Such a conclusion would cast no discredit whatever upon the officers and men who had charge of the "Maine" on that fatal night, for it is well understood and has been proved by accidents such as that which occurred on the French battleship "Jena," that under the conditions in which powder was stored at that period and for some years later it was possible for spontaneous combustion to have taken place in spite of that strict observance of regulations, which the evidence before the Board showed to have been followed on the "Maine."

Now, if this occurred, the tearing asunder of the protective deck and the blowing out of the sides of the vessel, accompanied by the instant flooding of the portion of the ship forward of the explosion, would have caused the weight of the ram bow, the anchors and anchor chains, to bend the forward portion downward until the ram was hanging vertically below the ship, held thereto only by the floor and keel plates. Then, as the main portion of the ship filled and sank, the bottom of the ship would naturally be folded down vertically against itself, leaving the keel and the double bottom in that peculiar, inverted V position, which gives it the appearance of having been blown up by some powerful force acting from below.

When the cofferdam has been built entirely around the wreck and the water pumped out, it will be possible, in all probability, by a careful examination of the wrecked structure, to determine how far this theory is correct. If it be proved, there will be cause for general congratulation. With that awful tragedy transferred to the category of unpreventable accidents, a proud nation with whom we are in friendly relationship will be vindicated from a charge which even today is a source of resentment that is none the less real because it is unexpressed.

REVIVAL OF THE ROTARY ENGINE.

IN the introductory article of a series dealing with the rotary engine which was published in the year 1897 in the SUPPLEMENT (Vol xliii, Nos 1109, 1110, 1111), we said: "The constant failure that has attended the efforts to produce a successful rotary engine, and the fact that the direct acting crank and rod, reciprocating engine has retained full possession of the field, have led many people to suppose that the rotary engine inventor is as visionary a dreamer as the would-be inventor of perpetual motion. As a matter of fact, however, many of the objects aimed at in the first device are as legitimate and useful as those of the latter are absurd and impossible. While the supposed advantages of a rotary engine as outlined below, have proved very attractive to the inventor, the results of careful comparative tests have shown that except in the case of rotary impact engines or steam turbines, the rotary engine does not compare in efficiency with the ordinary reciprocating type. . . . Now it would certainly seem that with such theoretical and practical mechanical features in its favor, the rotary engine would prove a formidable rival to the standard type. But this it has never done, and for the very practical reason that owing to its peculiarities of construction, it is difficult to secure an economical regulation of the steam supply, and it is impossible to keep the joints steam tight and prevent irregular wear of the parts. The wear of the piston is always greatest at the circumference of the cylinder, decreasing toward the center, and this structural defect has thus far baffled the efforts of the mechanic. The packing devices that bear against the circumference of the cylinder, like the piston rings of a vertical direct-acting engine, show an equal wear throughout, but no amount of ingenuity has yet succeeded in compensating the variable wear of the side packing. There is a further difficulty in the fact that in rotary engines that have only one admission port the steam pressure produces a rapid side wear on the shaft, and renders it difficult to keep the stuffing box steam tight. Another difficulty is experienced with the valve gear, which in the great majority of rotary engines is of the reciprocating type. Reciprocations which would involve no serious wear at a moderate speed become serious at the enormous speed of the rotary engine, and produce rapid wear of the parts."

Such was the situation in the rotary engine field about a dozen years ago. The difficulties were of a purely mechanical kind, for the theoretical advantages of the type were highly attractive and never disputed. We remember asking the late George M. Hopkins, a mechanical engineer of exceptional constructive ability, who had devoted a large amount of effort to the problem, what he thought were the prospects for the production of a successful motor of this type. He expressed the opinion that the large steam leakage, due to the impossibility of making successful frictional joints coupled with the heavy frictional losses, to say nothing of the rapid wearing out of the reciprocating valve movements had convinced him that no successful rotary could be built.

As the matter then stood, it was evident that a rotary engine, to be successful must be absolutely rotary in all its parts and free from any reciprocating movements whatsoever, that the rubbing surfaces must be reduced to a minimum, if not altogether eliminated, that steam leakage must be greatly reduced; and that some mechanical means must be found for eliminating the uneven wear on the main bearings due to the eccentric application of the load. In the intervening years, in spite of apparently insuperable difficulties, inventors have struggled with the problem with that indomitable perseverance which is so frequently characteristic of their work, with the result that at last a rotary engine of twenty horse-power has been developed, which has shown its ability to perform steady shop duty, day in and day out, for a period of months, without showing any signs of deterioration. Reference is made here to the exceedingly interesting engine, recently tested at Stevens Institute, which forms the subject of an illustrated article on another page. It will be recognized, on a study of the drawings and description, that success has been achieved by meeting those very conditions of a mechanical nature, which the experimental work of the past hundred years had shown to be essential in a rotary engine. The tests at Stevens Institute and at the contractors' plant speak for themselves. It remains for the future to determine how far the rotary will succeed in the new field of high-pressure, superheated steam, for which, theoretically, it would seem to be admirably adapted.

THE GOVERNMENT AND THE INVENTOR.

THE Committee on Patents has under consideration a bill introduced by Mr. Currier, the purpose of which is to enlarge the jurisdiction of the Court of Claims so that the Court may entertain suits against the United States for the infringement or unauthorized use of a patented invention in certain cases, and award reasonable compensation to the patentee.

The measure is necessary, when it is considered that under the English common law, which prevails in this country as well as in England, a sovereign power cannot be sued without its own consent. The United States has established a regular tribunal, and charged it with the duty of adjusting claims against the government but the scope of its duties does not include the adjudication of an inventor's rights when his invention has been appropriated by his government.

When the government issues a patent, it does not grant a favor to the inventor, but it "secures him a right," in the language of the Court in U. S. vs. Palmer (128 U. S. 271), and this securing of a right by no possible implication carries with it the opposite power of destroying the right in whole or in part by appropriating it to the purposes of government without complying with that other condition of the Constitution, the making of "just compensation."

For all that many inventors have spent years of their lives and practically bankrupted themselves in developing inventions primarily of use to the government only to find in the end that their property has been practically confiscated, that they have no legal means of redress, and that the governmental departments will not recognize the decisions of the courts. No doubt the government has the right to appropriate an invention necessary for the preservation of the national defense, yet appropriation having been made, it would seem that some compensation should be paid.

Despite the decisions of the Supreme Court, despite the fifth amendment to the Constitution, which provides that no private property shall be taken for public use without compensation, the government again and again seizes private property, in the form of patent rights, without compensation. The Court of Claims now has no jurisdiction to award compensation for the governmental use of a patent, except when such use is under a contract. To extend the jurisdiction of the Court so that it may entertain suits and award compensation to the owners of patents in cases where the use of the invention by the United States government is unauthorized, is the purpose of Mr. Currier's bill.

A similar measure was introduced by Congressman Dalzell in the closing days of the last Congress. The measure passed both the House and the Senate, but it was not signed by the President. Mr. Currier's bill is practically the same as Mr. Dalzell's with the exception that certain patents taken out by government officers or employees, which are good against all the world, are not good against the government. This is as it should be; for when a government officer is assigned to the task of devising an implement, and the government bears the expense incidental to the invention, and the officer continues to draw his salary in the meantime, it is evident that the government is the implied owner or at least licensee of the invention.

The experimental researches into the effect of electricity upon fog commenced by Sir Oliver Lodge in Liverpool, and continued by him in Birmingham, have been temporarily suspended. The reason for this, the Electrical Engineer states, is not any modification of Sir Oliver's views on the subject, or any cessation of his interest. It is simply that the spot selected for the experiments in the neighborhood of the old university buildings in Edmund Street has failed to furnish the *corpus vile* in the shape of fogs to disperse. There is a proposal to conduct a similar experiment under Sir Oliver Lodge's direction and on a more extensive scale in London, somewhere in the neighborhood of Hungerford Bridge, where it is hoped a choice assortment of fogs may be more often available. A sum of about $5,000, however, is required in order to enable this installation to be made, and at present it is not clear how the funds are to be obtained.

ENGINEERING.

It is claimed by the contractors that a new record for American shaft sinking has been accomplished on the Moodna siphon of the New York city Catskill aqueduct, where a shaft 16 feet 8 inches in diameter was sunk 177 feet in thirty-one days. The work was done in hard Hudson River shale

In a recent government test over the measured mile course off Rockland, the new battleship "Michigan" covered the fastest mile out of twenty successive runs at a speed of 19 54 knots, which exceeds by more than half a knot the fastest mile made at the builders' acceptance standardization trial.

The first of three concrete barges which will be used in the hydraulic operation at the Panama Canal was recently launched. It draws when complete with dredging pump, motor, and equipment, three feet nine inches One-quarter-inch No 12 wire mesh has been used in the wall construction The behavior of these barges will be watched with great interest

The Interstate Commerce Commission has recently ruled that, hereafter, on several railways in the Northwest, the upper berths in Pullman sleeping cars are to cost less than the lower berths The Commission states that, in the past eleven years, the Pullman company has doubled its capitalization and dividends without the investment of any new capital

The latest report of work on the New York State barge canal shows that this great undertaking is being pushed through with dispatch At the present time, 332.6 miles of the total work is under contract, additional plans have been completed for 48 2 miles, and the plans for another 26 4 miles are over seventy-five per cent completed, leaving 6 4 miles, the plans of which are in progress.

With a view to determining whether or not the new type of shells will be deflected when striking at an angle, or whether they will bite into the plate, several of the new soft nosed naval shells were fired from a 12-inch gun at the old ram "Katahdin,' which was stricken from the navy list, and consigned to the scrap heap in July of last year The hull was protected by the latest 12-inch armor plate, in sections arranged on the vessel at various angles

An eyebar made by the American Vanadium Company was recently tested to destruction by the American Bridge Company The test bars, which were of vanadium nickel steel, measured 14 inches by 2 inches by 35 feet. The results showed an elastic limit of 80,840 pounds, and a tensile strength of 99,890 pounds per square inch, with an elongation of 32 5 per cent in 12 inches, and a reduction in area at fracture of 52.3 per cent Part of the bar was bent cold under a 14,000-ton press, and flattened upon itself without sign of fracture Should the matter of price not prove an obstacle, this will be an ideal material for the eyebars of long-span bridges.

Efficiency tests are conducted by officials of the Pennsylvania Railroad, who, at unusual times and places, set signals of caution or danger, display fusees, or place torpedoes on the track, with a view to keeping all employees constantly on the alert for signals. During the tests for 1909, the following records were made by the men Block signal rules, 47,384, of which 99 6 per cent showed perfect observance on the part of the employees, 45,887 tests of rules governing flag men, use of fusees, torpedoes, and other signals, 99 6 per cent perfect. Altogether, some 300,000 efficiency tests showed a practically perfect record for the employees.

Acting in accordance with the Spooner act of June 28th, 1902, which states that "the President shall cause to be constructed such safe and commodious harbors at the termini of the Panama Canal, and make such provisions for their defense, as may be necessary for the safety and protection of said canals and harbors," President Taft has asked for an appropriation of $4,-000,000 for the commencement of suitable fortifications. He indorses the report of a special board of officers of the army and navy, which provides, we understand, for an adequate defense by batteries mounting the new 14-inch gun The total cost of the completed fortifications will be about $15,000,000

A most commendable movement in the anthracite region of northeastern Pennsylvania is the introduction of mine schools. In former days, the English-speaking and Teutonic races, skilled in mining, predominated in this district; but to-day work is done by a class of Europeans whose traditions and experience have nothing to do with mines. Several of the mining companies have established schools for the benefit of these employees, one of the first of which was that established by the Philadelphia & Reading Coal and Iron Company. Here, in attendance, are found the apprentices and journeymen employed in the shops and the mine workers. The course, which includes mathematics and drawing, has special reference to the particular class of work in which the [illegible] are engaged.

ELECTRICITY.

In his presidential address before the American Electro-Chemical Society at Pittsburg, Dr Leo H Baekeland stated that "the last hundred years, under the influence of the modern engineer and scientist, have done more for the betterment of the race than all the art, all the civilizing efforts, all the so-called literature of past ages, for which some respectable people want us to have such an exaggerated reverence"

The thirty-third convention of the National Electric Light Association, which met at St. Louis last week, reported a very prosperous year, in which 2,200 members were added, bringing the total membership up to 5,270 The association began in 1885, with a membership of only 71 There are 820 operating companies represented in the association, and these constitute 90 per cent of the capitalization of the electric light industry in this country

A new form of mercury-rod interrupter has been developed, with the object of producing a sharper break. It consists in covering the mercury with a quenching liquid As the rod is withdrawn from the mercury, a bubble of vapor from the quenching liquid forms on the end of the rod and tends to press the mercury level suddenly downward at the break, thus effecting a more perfect current interruption, even though the rod may rise comparatively slowly from the mercury

The New York Legislature has passed the bill which places telegraph and telephone companies of the State under the supervision of the Public Service Commission for the second district The bill empowers the Commission to investigate and regulate the rates and service The companies are required to file annual reports, and the Commission may veto any privileges under the franchises of the companies which have not as yet been exercised Reduced rates, passes, or franks for the transmission of messages are prohibited

A novel ventilating system has recently been developed, which consists of a small electric fan connected to the window sill in such manner that it may be operated either to draw in air from the outside or to exhaust the air from a room It is suggested that the value of this will be appreciated in a kitchen on ironing day, or when any baking is being done, as it prevents the heat from spreading through the entire house, besides making the kitchen itself more comfortable to work in

In order to determine the heat generated by concrete when hardening, six thermometers of special construction are to be imbedded in the concrete walls of the Gatun locks of the Panama Canal Each thermometer consists of an iron cup in which is a resistance coil This is connected by a pair of lead-sheathed copper wires to an indicating instrument and a small storage battery Variations in the temperature of the coil produce variations in the electrical resistance, and this is indicated on the instrument, which is calibrated to show degrees of temperature The instrument keeps a continuous record, which should prove of considerable scientific interest and importance.

It is a difficult matter to measure very high tensions of electrostatic or Wimshurst machines, owing to the glow discharge which is apt to occur above 40,000 volts. A new method has been adopted by Prof C F Guye and Mr A. Tscherniavski, which was recently submitted to the French Academy of Sciences This consists in inclosing the spark gap and the electrometer in a substantial box, in which compressed gas is introduced According to the Paschen law, the disruptive potential is approximately proportional to the gas pressure Thus, with a given potential difference, the electrodes of the spark gap can be approached to each other in proportion to the increase of gas pressure, and by this shorter gap the electrostatic effects are reinforced, insuring more accurate readings. This method has been employed in measuring the tension of a Wimshurst machine, which showed a voltage of 80,000 with a pressure of from 4 to 9 atmospheres in the inclosing box.

Last November there was a series of heavy snow storms in Germany, which did considerable damage to overhead telephone and telegraph lines As a result, a careful investigation was made of the question of putting such lines underground, and it was found that by using the Pupin system, underground cables could be used to good advantage on lines of less than 600 miles in length, with wires not more than three millimeters (0 118 inch) in diameter. The advantages of the underground system were found to be as follows: That there would be no interruptions due to external causes, that there would be no danger of cross talk, that the efficiency of the line would always be constant, that there would be no interruptions or expenses for repairs, due to external causes, and that while laying the cables extra wires could be provided, which would permit of further expansion to meet future demands. It was also shown that telegraph and telephone lines could be laid in the same cables without danger of inter-disturbance.

SCIENCE.

Mr. Charles H. Peck, botanist of the State of New York, in his annual report states that the known species of edible mushrooms in New York amounts to 200 Five new kinds of edible mushrooms were discovered in the last year

Dr. Charles Forbes, of the Department of Physics in Columbia University, has installed in Barnard College the first permanent apparatus for the installation of the Foucault experiment, to show the motion of the earth Dr Forbes set up a temporary apparatus for the experiment in St. Paul's Chapel of Columbia University some two years ago, which was described in these columns

Dr William Phipps Blake, a member of the first class ever graduated from the Sheffield Scientific School of Yale, died recently at Berkeley, California, shortly after he had received the degree of LL D from the University of California. Prof Blake was 84 years old When he graduated from Yale in 1853, he became the geologist and mineralogist for the United States Pacific Railroad expedition His numerous activities included the editing of the Mining Magazine, geological work for the Japanese government, the exploration of a section of Alaska, the teaching of mineralogy and geology in the College of California, a geological examination of Santo Domingo, and the teaching of geology in the University of Arizona

The satisfactory examination of the absorption spectra of glass of various sorts requires, in addition to the thermopile, a spectrometer with glass or quartz lenses and prisms, and the exact determination of the wave length of the limit of transparency requires the use of a slit with very sharp edges a camera with an excellent lens, and a source of light the spectrum of which contains many sharply-defined lines and extends far into the ultra violet The spectra hitherto employed for this purpose including the spark spectrum of an alloy of cadmium, zinc, and lead, the spectrum of mercury, obtained by means of the vacuum tube or the electric arc, the spectrum of the carbon arc and even that of the Heraeus amalgam lamp (mercury, lead bismuth, zinc, and cadmium), contain too few lines to give satisfactory results. Zickendraht has recently employed the arc spectrum of iron, which, because of its extraordinarily large number of lines of accurately known wave length, appears especially well adapted for the study of absorption in glass A Zeiss spectrometer with quartz lenses and prisms was used The results, which are published in tabular form, are too complex to be briefly described.

Prof. Haber claims to have solved the problem of the direct synthesis of ammonia from its elements nitrogen and hydrogen The process has been purchased by the well known German establishment, the Badische Anilin und Soda-Fabrik If the process is as practical and economical as its inventor claims, its introduction will quickly cause a revolution in a comparatively new but already important branch of industry, the manufacture of artificial nitrates In several countries possessed of abundant water power, large nitrate factories in which oxygen and nitrogen are combined directly by means of the electric arc, are in operation Prof Haber gives a few details concerning his process, but states that the combination of hydrogen and nitrogen is effected at a temperature of about 1,000 deg F and a pressure of 200 atmospheres. In a recent lecture he exhibited an experimental apparatus which produced three ounces of liquid ammonia per hour The presence of a catalyzer is required to accelerate the combination For this purpose, Prof Haber employs uranium, but the rarity of this element appears incompatible with its employment on a commercial scale

The adulteration of food in France is said to result in a profit of one hundred million dollars per year Bread, which may be called the national food of France, has long been adulterated largely with talc, a substance which is not only indigestible, but is exceedingly irritating to the gastro-intestinal mucous membrane because of the sharp crystal fragments which it contains. Flour is often mixed with alum or with potassium carbonate to increase the amount of water absorbed, with zinc sulphate to keep the bread fresh with copper sulphate and ammonium carbonate, to diminish the quantity of yeast required and to improve the appearance of bread made with spoiled flour Denatured alcohol, costing one-eighth the price of pure alcohol, is used for the manufacture of the liqueurs and *apéritifs*, which are so largely consumed in France Alcohol, denatured by the addition of methyl alcohol, is mixed with an equal volume of water and exposed for a few days to the sun air and rain, which have the effect of precipitating the methyl alcohol so completely that its flavor remains barely perceptible The mixture is then brought to the desired alcoholic strength by the addition of strong spirits, flavored to suit the taste of the consumer and sharpened by the addition of a pint of nitric acid to each barrel.

A COMMERCIAL ROTARY ENGINE

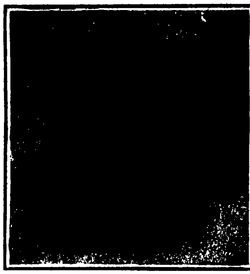
PRACTICAL SOLUTION OF AN AGE-LONG PROBLEM

Elsewhere in this issue we have discussed editorially the problem of the rotary engine and set down the mechanical difficulties which must be mastered before a successful engine of this type can be produced. Reference was made to the fact that a recent rotary engine has undergone a successful laboratory test at the Stevens Institute and a successful commercial test of six months' duration at the plant of a leading contractor in this city This engine, which was designed and built by Mr Gerardus P Herrick, of 74 Broadway, this city, forms the subject of the accompanying illustrations. The principal distinguishing features—those which contribute more than any others to its success—are, first, the fact that reciprocating movements are entirely eliminated, all of the movements being rotary and secondly, that the main shaft of the engine runs upon a film of steam, whereby the destructive thrust, transverse to the axle, is completely counterbalanced

MECHANICAL FEATURES.—The engine consists of two rotors or drums of equal diameter, placed one above the other, and running with the barest clearance between their peripheries By means of external gears, they are caused to rotate in opposite directions at the same speed The upper drum rotates within a closed cylindrical casing, between the walls of which and itself there is a bare micrometer clearance The lower, or what we might call the power drum, rotates within a casing of larger diameter than itself, and it is provided with a rectangular piston which fills the annular space between the external periphery of the drum and the internal periphery of the casing This drum and its attached piston also rotate within their casing with only a micrometer clearance between the adjacent surfaces. The peripheries of the upper and lower casings intersect each other sufficiently to allow the upper drum to project within the lower casing until it rotates with only the slightest clearance between itself and the power drum

VALVE MECHANISM.—Sunk in the upper drum is a transverse, semicircular recess, which serves at once as a pocket to admit the piston of the lower drum as the two drums roll together, and also as an admission valve for the live steam, the proper registering of the piston with this pocket being assured by the fact that the two drums are geared together Steam is admitted on one side of the engine and exhausted on the other The successive admission expansion, and exhaustion of the steam are simple and easy to understand As the piston (which, viewed from the side of the engine shown in our drawing, moves opposite to the hands of the clock) clears the pocket in the upper drum the latter moves forward until its leading edge clears the lower edge of the steam inlet, when live steam is admitted to the annular space back of the piston and continues to flow therein until the after edge of the pocket has swung round clear of the steam cylinder This point of cut-off is the position chosen for the accompanying illustration. During the rest of the stroke, the steam works expansively, until the after face of the piston clears the forward edge of the exhaust ports, which are shown in dotted lines at the end of the circular path swept through by the piston

STEAM COUNTERBALANCE.—The most original and valuable feature of this engine is the ingenious method by which the heavy load on the main shaft, due to the radial steam pressure in the cylinder, is exactly counterbalanced by a steam pressure acting in the opposite direction, the rotor being balanced in its own steam This is accomplished by means of what are known as balancing plugs, which are inserted in steam balancing chambers. There are two of these plugs, one on each side of the engine. They are made of sufficient length and diameter to provide an area which, at any part of the stroke, is exactly equal to the area of the surface of the drum which is under the pressure of the live steam For a little over half their periphery, and on the side immediately opposed to that portion of the annular cylinder space upon which the heaviest steam pressure is developed, the balance plugs are provided with a series of recessed steam pockets, and steam is admitted to these pockets successively by a series of holes drilled through the drum. Consequently, the thrust of the steam toward the shaft of the rotor is, for all positions, constantly balanced by an equal thrust of the steam away from the shaft. Perfect balance is secured, the rotor practically running upon a fine film of live steam. The advantages of this ingenious arrangement are that not only are [illegible] friction and destructive, uneven wear at the main journals prevented, but it is possible to mount the rotor on finely adjusted ball bearings, whose duty is simply to keep the rotor in true axial alignment.



The piston is shown at cut-off. Note small holes back of piston to admit steam to balancing-chambers.

Rotary engine with side plates removed

By this device the rotor rides on a film of steam and the load is taken off the main bearings.

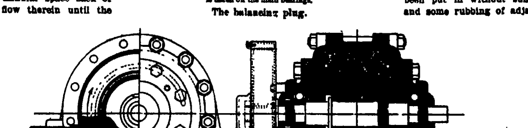
The balancing plug.

ABSENCE OF RUBBING SURFACES.—Another feature which has contributed largely to making this rotary engine practical, is the abolition of packing devices between the adjacent moving surfaces. Knowing the impossibility of keeping the usual packing devices steam-tight, Mr. Herrick decided to abolish them, and reduce leakage by machining the parts so carefully that they could be adjusted to run with the smallest micrometer clearances. That this has been accomplished successfully is proved by the fact that in the tests at Stevens Institute, this engine developed [illegible] brake horse-power on a steam consumption of [illegible] pounds per brake horse-power per hour; which compares favorably with the steam consumption of the average reciprocating engine of similar capacity. It will be realized that by getting rid of packing devices and introducing a system of steam balancing, Mr. Herrick has not only prolonged the life of the rotary engine, but he has greatly increased its output by getting rid of that accumulated friction which, in earlier forms of the rotary, was sufficient to cut down the economy to a point which rendered them commercially unserviceable

LABORATORY TESTS.—In his report of the laboratory tests at Stevens Institute, Prof Pryor states that he obtained the following results With a steam pressure of 145 pounds and 1,006 revolutions per minute, 20 48 brake horse-power was obtained with saturated steam, on a consumption of 50 7 pounds of water per brake horse-power per hour With a steam pressure of 135 5 pounds and 55 deg. of superheat, the engine at 1,008 revolutions per minute developed 20 40 brake horse-power on a consumption of 44 4 pounds of water per hour In commenting upon these tests, Prof Pryor says of the engine "Its steadiness of operation, its lack of vibration, and its output per cubic foot of space occupied, should be particularly commended"

COMMERCIAL TEST.—To test its commercial value over a long period of time, the engine was coupled to a dynamo at the Degnon Contracting Company's plant in this city, and from August 14th to December 21st, 1909, it served to produce the current for lighting the plant day and night It was run for 1,685 hours, or the equivalent of more than six full working months. At the end of this time, it was again tested at the Stevens Institute; when, under similar conditions of revolution and steam pressure to those which obtained at the first test, the steam consumption was found to be 52 6 pounds, the slight increase being attributed by Prof Pryor to the fact that new ball bearings had been put in without sufficiently careful adjustment, and some rubbing of adjacent surfaces had occurred

FUTURE FIELD OF THE ROTARY.—Apart from the field of usefulness open for the rotary because of its compactness, simplicity, perfect balance, and moderate steam consumption, there is a far wider and more important field presented in connection with the steam turbine. We have frequently in this journal drawn attention to the fact that the steam turbine is most efficient in the lower ranges of the expansion of the steam; and that in the higher ranges, because of leakage over the ends of the blades, it is not so economical; and that at low speeds it is decidedly uneconomical. Furthermore, the turbine cannot economically make use of high-pressure steam or of superheated steam, and consequently it is shut out from all those well-known economies which the use of high-pressure and large superheat secure. Now the rotary engine is ideally adapted for both high pressure and superheat, and this fact is recognized by L. D Lovekin, the chief engineer of the New York Shipbuilding Company, in [illegible] "A practical [illegible] with any of the [illegible]



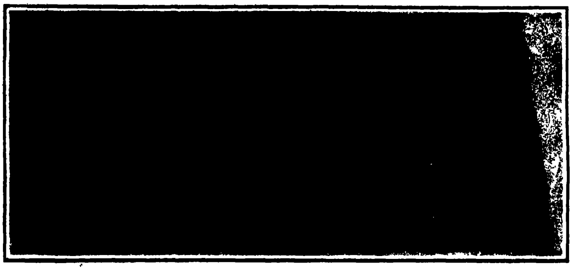
This view shows the valve mechanism at point of cut-off. Irregular sectional view, showing the piston within the valve pocket.

A PRACTICAL COMMERCIAL ROTARY ENGINE.

THE COSTLIEST EAR OF CORN IN THE WORLD

BY FRANK C. PERKINS

In the accompanying illustration we present ten champion ears of corn, which were sold at the rate of $1,345 per bushel, or $225 for the ten ears, one of the highest prices, if not the highest price, paid for that number of ears of corn. The champion single ear of corn was sold at the Omaha National Corn Show for $85, or at the rate of $5,950 per bushel, which is said to be the highest price ever paid for a single ear of corn. The champion ten ears of corn shown in the illustration average 10½ inches in length and 7¾ in circumference, each ear carrying 20 rows of kernels, the depth of the kernels being ⅝ of an inch, and the average weight of each ear was 20 ounces Prize agricultural products such as these may not be adapted to all localities, for which reason one must not be misled by the awarding of a prize In some localities the prize corn might not be so profitable, or at least not so profitable as other varieties. Furthermore, the price at which ears of corn are sold may be a fictitious or a forced one A farmer may take a prize at a fair When the corn is put up at auction, the farmer, having received a large amount as premium for the champion corn, can afford to bid it in at a higher price than his competitors The high price paid would therefore be for advertising purposes Lastly it must be considered that from a large field of corn some large specimens may be selected This does not prove that the selected specimens are the best, but merely the largest.



THE COSTLIEST EAR OF CORN IN THE WORLD

A GIANT RUHMKORFF COIL

BY JACQUES BOYER

The first induction coil was made by Masson and Bréguet in 1842, but it was not until 1851 that Ruhmkorff gave the instrument its definite form, which has not sensibly varied since that time, although it has been improved and modified for various applications. Ruhmkorff increased the number of turns of wire of the secondary circuit, for which he employed a very fine and very long wire. Perfect insulation was obtained by saturating the coil with gum lac and the intensity of the magnetic force was increased by inserting a core of parallel iron wires inside the concentric coils. These wires are magnetized by the primary current and the magnetic flux produces currents in the secondary circuit.

The principal improvements which have been made in Ruhmkorff's original coil are the following. In the first place, Fizeau increased the power of the instrument by connecting the ends of the primary coil with the electrodes of a condenser, composed of sheets of tin foil, insulated by silk and placed in the base of the instrument. The extra current which is formed on breaking the primary circuit flows into this condenser instead of forming a spark. The primary current is thus arrested more suddenly and the electromotive force of the induced current is correspondingly increased. For the construction of large induction coils [illegible] the plan of dividing the [illegible] [illegible] the other This method avoids the production, between two adjacent turns of wire, of a difference of potential sufficiently great to pierce the intervening insulation.

The interrupter, by which the primary circuit is broken at very short intervals, was improved by Ducretet, by giving it the form of a vibrating strip of metal, fixed at both ends and bearing at its middle point a plate of soft iron. The primary current flows through this plate and a metal point in contact with it. This contact is broken by the attraction which the core of the instrument, when magnetized by the passage of the primary current, exerts upon the iron plate. But this attraction ceases as soon as the circuit is broken, and contact is then immediately re-established by the elasticity of the vibrating strip of metal. In this way a very rapid interruption is produced. Very large induction coils are usually provided with Foucault's mercury interrupter, operated by a separate battery of one or two cells.

One of the largest induction coils ever made was constructed long ago in England for Spottiswoode, by the instrument maker Apps. Its length was 48 inches, its external diameter, 18½ inches, its total weight, 1,675 pounds, and the weight of its core of soft iron, 67 pounds. The primary circuit consisted of 3,150 feet of wire of a diameter of 1/10 inch. The length of the secondary circuit was 280 miles. It consisted of 341850 turns of wire. This apparatus, operated by 30 Grove cells, produced a spark 40 inches long

A still larger coil was recently constructed in Paris by Carpentier The secondary circuit of this instrument is composed of 97½ miles of copper wire of a diameter of 1/125 inch The soft iron core has a length of 80 inches and a sectional area of 9.3 square inches The primary coil contains 792 turns of copper ribbon, about ¼ inch broad and 1/25 inch thick arranged in six layers. The coil is surrounded by an ebonite tube more than ½ inch thick This giant induction coil, operated by a current of 110 volts and 30 amperes, produces a spark about 50 inches in length.

A GIANT RUHMKORFF COIL.

The Canadian Government have appropriated $50,000 for experiments in electrical smelting, which are to be conducted under the supervision of Dr Eugene Haanel, superintendent of mines for the Government of Ottawa.

FIRE FIGHTING WITHOUT FIRE ENGINES.

BY HERBERT T WADE.

The practical elimination of the fire engine from fire fighting in the business section of lower Manhattan has been brought about by the successful use of the high pressure independent fire service Good results have attended also this modern method in Brooklyn, Coney Island and Philadelphia, and in all of these places independent systems of high-pressure mains supplied from central pumping stations now are essential and established elements in much needed fire protection The frontispiece of this week's SCIENTIFIC AMERICAN illustrates the method and its application by the firemen, and while it is not intended to represent any particular plant, yet it shows the essential features of a modern high pressure pumping station with motor-driven pumps and the use of the hydrants along the distribution system, such as are employed in New York city

Now if a pressure of water at the hydrant can be maintained as great as that furnished by the pumps of a fire engine then the latter of course is superfluous, and that, along with adequate water supply, is what, in short, the high pressure system accomplishes This condition however, so successfully realized, has been made possible only by modern mechanical and electrical engineering, to which the firemen have added by intelligently studying and applying the new resources at their command Referring to our illustration, it will be seen that the pumping station has two sets of intakes for its water supply—one for fresh water and the other, which is in connection with a vacuum pump, for salt water In the case of the New York system, the Croton water is used under all normal conditions, and the mains are kept filled at the ordinary city pressure The drafts on the city's supply for fire purposes compared with the usual daily consumption are inconsequential, but the river or salt water may be drawn at any time through intakes extending direct to the pier slips, and is available in case of any failure in the fresh water supply or at a time of a large conflagration For high pressure stations either gas or electric motors are available to drive the pumps, as there is always a supply of this kind of power from public service corporations distributed underground, and carefully protected and duplicated in such a way as to make any possible failure highly improbable Thus in the Manhattan pumping stations the high-efficiency centrifugal pumps are driven by induction motors using alternating current from the Edison Electric Company, with direct connection with its Waterside station and duplicate connection with its sub-stations, provision even being made to connect with Brooklyn in case of emergency A contract between the city and the company requires a constant reservation of power, and the simple operation of switches puts the machinery into full operation The centrifugal pump has been found most advantageous, particularly with electric motors.

A high pressure system protects a given district where the mains and hydrants have been installed and in the case of New York this territory extends from Chambers to Twenty-third streets, and lies between the Hudson River and the Bowery and Third Avenue. The pumping stations are located outside of districts likely to be affected by any possible conflagration, and free from danger from neighboring buildings. They are situated at South and Oliver streets and at Gansevoort and West streets. The hydrants in this system are of the type shown in the illustration, and are spaced along the mains at an average interval of 270 feet, and to reach a building on fire in no case would there be required a length of hose greater than 450 feet, an important consideration, as the pressure in a line of hose diminishes rapidly

Let us assume that a fire breaks out in this protected territory, and the alarm is transmitted in the usual way, either from a street box or an automatic fire-alarm telegraph to fire headquarters. Thence it is sent out over the fire-alarm circuits to the various fire houses in the city including the two high-pressure stations. At these stations night and day there is always an operator on duty who sits at a telephone switchboard by which the station can be put in communication not only with the scene of fire but with headquarters and with the other station Special telephones in metal boxes are distributed in close proximity to the hydrants through the high-pressure district, and connect direct to the station, a special service being maintained by the telephone company In front of the operator is a large board containing the numbers and locations of the various alarm boxes throughout the district, those to which his own station responds immediately being designated in red The alarm comes in over the regular circuit the gong sounds the appropriate number, which is also registered by perforation on a tape, on which also is printed the time by a clock. If the alarm is one for the station, the operator immediately grasps the lever of the marine telegraph, and the signals to start are sounded and shown on the large indicator on the wall. The crew spring immediately to their places, the chief engineer at the switchboard and the oilers and machinists at their appointed stations. From the switchboard everything can be controlled and regulated The current is switched to the motors, and the ponderous pumps are soon revolving, another switch opens electrically-controlled valves regulating the water supply, while recording and other meters and indicators are before the eyes of the chief engineer. Not every fire requires the flood of water that can be set in motion from the station, and the standing order is to start one pump, regulating the pressure at the outlet at 125 pounds. The next order must come from the chief of the fire department at the fire, and may be a call over the telephone to increase both water supply and pressure or an order to shut down the pumps. As shown in the picture, the chief at the fire is even in closer touch with the pumping station than he could be with a number of separate engines located at the scene of activity The scene within the station when the pumps are in operation is hardly one of extraordinary activity, and no greater excitement is manifested than in a well-appointed power plant. The electric control of the chief is so complete that he does not need to leave his position at the switchboard, and with ear open for orders and eye on his meters and indicators, the entire situation is at his command

Outside with the firemen there is naturally more activity, and high pressure working has occasioned certain changes in equipment and methods From the beginning the high pressure required the best and strongest hose procurable, and this in sufficient quantity is carried in large wagons These hose carts are moved from the rear of the fire houses, from which they followed the engines, to the front and are given right of way over other apparatus in the streets. When the reliability of the high-pressure service was established, for most alarms the engines were not sent out, but held in reserve in the fire houses. In two houses the engines were entirely removed and double section hose companies maintained As the hose is heavy, the work of carrying and hauling it is particularly arduous, so that, in this respect, the labor of the firemen at the fire has not been lightened by mechanical progress. The automobile hose wagon used by the New York Fire Department, however, has demonstrated its complete usefulness for transporting the heavy loads of 3 inch hose much more rapidly than the tenders drawn by horses. Immediately on reaching the fire, the hose is unloaded, a length connected with the hydrant outlet, of which there are four, and successive lengths are laid to the scene of action The former engineer of the fire engine with his lever key takes his position at the hydrant and watching the pressure gage at the outlet, opens or shuts the valves as ordered. The line is stretched where the exigencies of the occasion demand, perhaps to the standpipe connection which must be placed at the sidewalk close to the building walls, and which connects with the standpipe itself within the building with its outlets and hose reels on each floor It is this that affords the fire protection to a skyscraper, in addition to the pumping plant of the building, and must be used by the firemen for the higher stories, or it may be used to deliver a stream to a fire in an adjoining building The connection may be made to the sprinkler system of the building through a similar outlet or to a cellar pipe to flood the basement, or, as shown in the illustration, two lines may be siamesed into the water tower The permanent nozzle holders of the hose wagons may be used, while for a single stream the tripod nozzle holders are employed, as the powerful pressures render holding the hose and directing it practically impossible even for two or three firemen The hose may even have to be hoisted up onto a fire escape, and there fastened or clamped with one of the devices which have been developed for this purpose Now a single line from one of the four outlets is practically as powerful as that derived from a fire engine, so that the concentration of pumping power on any single block can be appreciated Further, when it is realized that these streams can be delivered with a force sufficient to tear off cornices and make their way into the very seat of the fire, their power may be appreciated

The New York Fire Department's use of the high-pressure system has been most successful, and quite on a par with the excellent engineering involved in its design and construction A sufficient quantity of water is brought to bear at the earliest possible moment, and this usually quenches any ordinary fire in short order If however, it proves stubborn, then it is straightaway drowned out in the building where it originates, and in no case since the high-pressure service has been used in New York, has a fire progressed beyond the building where it began. In the extension of the system on the East Side of the city the distribution mains will be laid duplex in adjoining streets, passing out from the pumping station into two systems of mains, ordinarily connected but capable of being isolated by the gate valves at the station and by distant electrically-operated valves at some point of intersection. With the Philadelphia system, which incidentally uses gas motors and direct-acting pumps, in use for a number of years, and which has recently been extended, and with a well-planned project under way in San Francisco, it would seem that the day of the fire engine had passed and that the central fire protection method would soon take its place in many other large cities.

A High-Pressure Fire Reduction Valve.

Soon after the successful inauguration of the high-pressure fire service in New York city, the SCIENTIFIC AMERICAN* called attention to the need of a suitable regulating valve to be used at the hydrant, in order to render possible the control of the pressure on any single line of hose and its adaptation to the work in hand. The need of such a valve has become increasingly apparent

For some purposes, as for a water-tower or the stand-pipe of a skyscraper, the highest pressures may be demanded, while for other lines at the same fire low pressure streams which the firemen can hold and manipulate readily are required, as for the lower floors of the same or an adjoining building. What was needed, as was pointed out in the SCIENTIFIC AMERICAN, was a device light and portable, that could be applied readily with the hose at the hydrant outlet and enable any pressures from zero to the maximum at the hydrant to be passed with a minimum loss in volume of water from friction and otherwise

This seems to have been secured in the Kiely and Mueller valve, which recently has undergone some thorough tests by the New York Fire Department, and has been adopted for high-pressure companies and fireboats

The valve is small and compact designed to be transported on the hose tender with the smaller tools. There are two pressure gages, one on the inlet side showing the pressure at the hydrant furnished by the pumps, the other the reduced pressure as the water passes out of the valve into the line. After the hose has been stretched, the engineer opens the central valve of the hydrant with his key wrench, and then the gate valve to the outlet from which the line is taken The handle of the regulating valve is screwed down, allowing no water to pass A half turn of the handle in the direction of an indicating arrow allows water at a pressure approximately of 15 pounds to pass, a full turn 30 pounds, and so on up to the full or hydrant pressure. In short, the pressure on any line from such a valve is entirely under control, and the engineer merely has to watch his gage and turn his handle until the desired point is reached when the pressure is maintained automatically

In a recent test before the engineers of the New York Department of Water Supply, Gas, and Electricity witnessed by the author as the representative of the SCIENTIFIC AMERICAN at the St Edwards High Pressure Station in Brooklyn, it met every condition imposed Different pressures from 75 to 300 pounds were put on the mains by the pumps in the adjacent station, and the pressure on the line was reduced as ordered by simply turning the handle of the valve Thus when over 240 pounds was recorded at the hydrant, 40 pounds was delivered at the nozzle The adjustment and maintenance of any desired pressure were far more easily and satisfactorily controlled than would be possible with a steam fire engine Variations in the pressure on the mains did not affect sensibly the operation of the valve while when the line was shut down at the nozzle no effect was manifest.

The valve consists essentially of a valve body, containing a seat, main disk, piston, auxiliary valve; a diaphragm, a compression spring, an adjusting screw, a handle, and a small hand-operated by-pass valve The disk and piston are constructed of one piece, and the portion of the metal connecting the disk and piston has in it a small port through which high pressure passes up over the piston, which, being of greater diameter than the disk, drives the latter down to its seat, thus shutting off the pressure. The next part of the operation is brought by the opening of the auxiliary valve mentioned above, which being of greater diameter than the port through which the high pressure is conveyed to the top of the piston, quickly causes a reduction of pressure on the piston side sufficient to allow the initial pressure to open the main valve or disk. As soon as the reduced pressure has become sufficient to force the diaphragm up against the pressure exerted by the adjusting spring, it causes the auxiliary valve to close, thereby bottling up the pressure above the piston, which, owing to its greater area, causes the main valve to close. This operation is repeated as often as occasion may require. The function of the small by-pass valve also mentioned is to enable it to cause full pressure to flow through the valve when desired, as in a sudden emergency. The power to operate the valve is furnished by the initial pressure, whereas in most reducing valves it is the reduced pressure acting on the diaphragm [illegible] in the same way.

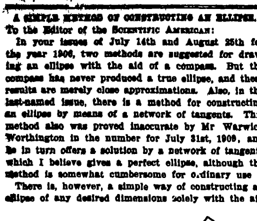
Correspondence.

A SIMPLE METHOD OF CONSTRUCTING AN ELLIPSE.

To the Editor of the SCIENTIFIC AMERICAN:

In your issues of July 14th and August 25th for the year 1906, two methods are suggested for drawing an ellipse with the aid of a compass. But the compass has never produced a true ellipse, and these results are merely close approximations. Also, in the last-named issue, there is a method for constructing an ellipse by means of a network of tangents. This method also was proved inaccurate by Mr Warwick Worthington in the number for July 31st, 1909, and he in turn offers a solution by a network of tangents which I believe gives a perfect ellipse, although the method is somewhat cumbersome for ordinary use

There is, however, a simple way of constructing an ellipse of any desired dimensions solely with the aid



A SIMPLE METHOD OF CONSTRUCTING AN ELLIPSE

of straight-edge and pencil. No originality belongs to my method, but it is readily proved to accord with correct mathematical principles

On a straight-edge or ruler mark off a distance QP, equal to half the desired major axis, also, from point P, a distance PM, equal to half the desired minor axis

Referring now to the drawing, we construct perpendiculars AA' and BB', and lay the ruler down so that the points Q and M fall exactly upon these perpendiculars. The point P will then fall somewhere on the curve of the proposed ellipse By shifting the ruler about, in such a way that Q and M always fall on lines AA' and BB', respectively, the mark on the ruler at P will give the position of any number of points, which afterward may readily be joined by a continuous line EDWARD M WEYER.

Washington and Jefferson College, Washington, Pa.

Astronomical Photography.

BY F V COLLINS.

The plan of photographing the entire heavens originated with Mouchez in 1887 The death of this eminent man of science was one of the adverse factors which have conspired to delay the work, which now, however, promises to draw to a triumphant conclusion

The importance of the universal photographic star chart to the astronomer of the future cannot be overestimated It is now generally acknowledged that the stars are in motion with respect to one another, and our entire solar system is in motion through space, so that one day the constellations will be seen from a sensibly different point of view Changes will come to pass in the apparent arrangement of the star groups, and in the course of years they will develop, so that something may ultimately be discovered of the real structure and laws of the distant bodies of the universe It may be that the chart now being prepared will enable the astronomer of some centuries hence to learn as much of the great universe of stars as we know of our comparatively minute solar system revolving within it.

Though photography has been demonstrated of late years to be the only method of revealing the structure of those fascinating formations, the nebulæ, at all adequately, the star chart on a large scale, though it be more prosaic to lay observation, possesses an incalculable value of itself The wonderfully accurate photographic chart may lead, with the aid of a correspondingly accurate system of measurement, to the discovery of entirely new laws of the universe which directly affect our own planet. Seth Chandler discovered the law and evaluated the magnitude of an oscillation in the position of the axis of the earth's figure, which had for years puzzled his astronomical colleagues, not as a result of any special series of observations made for the purpose, but upon the examination of measures made for divers ends at numerous observatories throughout the whole of the last century. And so it has always been a result of measurement when any great advance has been made in a knowledge of the laws which govern the universe. So it will have to be in the solution of the problems which confront astronomers to-day in every direction. The photographic chart, by making these measures more rapid and more certain than is possible by the old visual method, has practically revolutionized this most valuable field of astronomical research.

[illegible] of the superiority of the photographic chart over the older method of observation is quite simply explained. The image of a star in the telescope is very rarely absolutely steady, for the light, prior to its reaching the instrument, has to pass through the veritable sea of our own atmosphere, constantly disturbed, in practically all portions, by cold and hot-air currents Rifle shots are familiar with the sort of effect which is thus produced. On a blazing hot day, when currents of air are rising from the heated ground, the target seems to dance before the eyes, growing taller and shorter and breaking in pieces, with the bull's eye now in one corner and now altogether vanished Something of the same thing happens to the star image when the telescope is set up in any but a very few tranquil places, and especially when it is in a country much broken up by mountain chains or arms of the sea On all but two or three nights in the year the star image will be seen dancing and quivering in the telescope, more or less as the air is much disturbed or uniform And when the observer tries to set the spider line of his measuring apparatus upon the image, he has to make some sort of estimate of its mean position and set upon that. It is really surprising how accurately this can be done after long experience, but the unsteadiness of the object is bound to set a limit to the accuracy which even the most practised observer can obtain Now it might be thought that this constant vibration of the object would be more fatal to the photograph than to visual observation, but this is not the case For the motion is very rapid, several times a second does the star make a small jump from its mean position and return to it, and, on an average, it jumps every way with equal frequency The consequence is that the photographic plate, which keeps a record of every jump, produces in the end an image which is certainly larger than it ought to be, but which is, as a rule, enlarged equally in every direction, so that its center remains still where the center of the image belongs And when the plate is put under the microscope of the measuring machine—a device capable of accurately determining a fifty thousandth of an inch—and the threads which are moved by the measuring screw set upon the photographed image, the enlargement of the latter is more than compensated for by any advantage which accrues from a steady image

But the superiority of the astronomical photograph over visual observation is not confined to the star chart Numerous articles in popular periodicals have acquainted the general reader with the wonders of the nebulæ as revealed by the photographic plate The cumulative effect of light upon the latter renders it possible to obtain exquisite delineations of faintly luminous objects by means of a sufficiently long exposure. Vast new regions of space are thus being explored, and still vaster regions await further exploration Prof E Ray Lankester, in an address before the British Association, stated that "the invention of the dry plate, which has made it possible to apply photography to astronomical work is the chief cause of the great expansion of astronomy since 1881 ' To quote Prof Lankester further "It was the dry plate which made long exposure possible, and thus enabled astronomers to obtain regular records of faintly luminous objects, such as nebulæ and star spectra Roughly speaking, those visible to the naked eye may be stated as 8,000, this is raised by the use of the best telescopes to 100,000,000 But the number which can be photographed is indefinite, and depends on length of exposure, 1 000,000,000 000 can certainly be so recorded By the photographic method hundreds of new variable stars and other interesting objects have been discovered. New planets have been detected by the hundred Up to 1881, 220 were known During 1881 only one was found, namely, Stephania, being No 220, discovered on May 19th Now a score, at least, are discovered every year".

The appearance of Halley's comet this year suggests the fact that some of the most extraordinary revelations of photography in astronomy have been in the case of these strange members of the solar system The vast size and tenuity of comets render them very liable to disturbances from other celestial bodies The photographic plate has shown that the comets utterly transform themselves in a few hours' time These transformations are sometimes evidently due to gravitation from some neighbor, and again, apparently, from actual collision with planetary bodies or matter, which not only distorts but sometimes breaks the tail This was the case with one of the comets of 1893, where photographs on successive nights show the tail dissipated and broken, evidently by such an encounter. The presence of a new planet or of inter-planetary substance may be thus revealed. It is interesting to note that the present appearance of the comet of Halley will signalize the first occasion on which this famous body has been photographed.

According to Prof G. W Ritchey, of the Yerkes Observatory, it is now possible, with the aid of improved optics and mechanics, to construct a photographic reflecting telescope with as much precision and refinement as have been expended upon the great refracting telescopes. Prof. Ritchey has obtained splendid results from his two-foot photographic reflector, and his photographs thus obtained of the nebulæ have a wider appeal than to the scientific mind alone To many a person untrained in astronomical lore, indeed, the photograph of the great spiral nebula in the constellation of Andromeda, obtained with the Yerkes two-foot reflector, would probably appeal at once as that of a most marvelous spectacle—a vast planetary system in the making About the same proportion of the sun to the planets in our own system is to be observed in the great central spherical condensation of the whirling mass and the smaller condensations in the latter Some of these smaller condensations, at varying distances from the central semi-formed orb, have assumed an almost perfectly spherical shape, others, again, are formless, though vastly denser than the nebulous matter extending, in a circular or elliptical form, through out the entire spiral system It may be observed that the spiral character of this nebula was never even suspected until it was photographed in 1888 by Roberts with a reflecting telescope Yet the result then obtained was crude indeed when compared with what was obtained by the instrument at the Yerkes Observatory Seen by the naked eye, this great nebula appears only as an indistinct hazy spot among the stars. The greatest visual telescope in existence fails utterly to reveal the amazing spiral structure so brilliantly shown in the photograph

Judging from the results obtained with the two-foot instrument Prof Ritchey estimates that an eight foot reflector, if used in a climate where there are suitable atmospheric conditions, would photograph stars which are fifty times fainter than the faintest stars which can be seen with the largest modern refractors "This means,' says Prof Ritchey "that such a reflector would enable us to penetrate seven times farther into space than can now be done with the greatest visual telescopes, and therefore that such an instrument would reveal to us a universe seven times seven times seven—more than three hundred—times greater than the universe which is revealed by the most powerful modern refractors I know of no opportunity which has ever been presented in the entire history of astronomy greater than that which now awaits us in the construction of a large modern reflector and its use in astronomical photography "

It is estimated that the cost of such an instrument as Prof Ritchey advocates—that is, one of eight-foot aperture, and embodying the latest developments in optics and mechanics—would be about one-thirtieth that of building a battleship of the 'Dreadnought" type

The Current Supplement.

One of the most important articles in the current SUPPLEMENT, No 1796, is that by George Neumann, in which the compulsory working of German patents is discussed, a matter of great importance to American manufacturers The adhesion of locomotives is a most important factor in designing engines, and must be considered at every step in the preparation of a general design An article on this subject appears in the current SUPPLEMENT Rose's excellent description of a profile puppet show, and how it can be made and used, is continued When shipbuilders commenced turning out iron and steel vessels, navigators found themselves confronted with the problem of overcoming the magnetic forces of their ships and making their compass needles point toward the magnetic north How the problem is solved is told by William C Ward in a paper entitled 'Compass Deviations ' Frank C Perkins writes on Canadian pulp making in the Algoma district, Ontario Irish linens and some features of their production are discussed by Sir William Crawford

Three kinds of bench marks were used by the United States Geological Survey in the spirit leveling in Ohio from 1898 to 1908, inclusive, according to a bulletin by Messrs S. S Gannett and D H Baldwin The first form was generally used in the vertical walls of public buildings, bridge abutments or other substantial masonry structures, being a circular bronze or aluminium tablet, 3½ inches in diameter and ¼ inch thick, appropriately lettered, and having a 3 inch stem cemented into a drilled hole The second form was employed where masonry or rock formation was not accessible, and consisted of a hollow wrought iron post, 4 feet long and 3½ inches in outer diameter, split at the bottom and expanded to 10 inches so as to resist pulling from the ground These posts were sunk 3 feet in the ground—after having been coated with asphalt—and a bronze tablet similar to the one already described was then riveted to the top. The third form was little used and is now altogether discontinued, being the ordinary split bolt of copper, 1 inch in diameter and 4 inches long

HOW TO ESCAPE FROM A SUNKEN SUBMARINE

METHODS APPROVED AND DISAPPROVED

In a diving manual recently published by Siebe, Gorman & Company, Limited, submarine engineers of London, we find some excellent suggestions on the subject of saving the crews of submarine boats.

The problem of saving the lives of a crew of a submarine vessel is by no means easy of solution. The equipment and apparatus which is invaluable on shore is quite useless under water. It would be quite easy to construct a submarine boat, the crew of which would be safe under practically every conceivable set of circumstances, but such a vessel would be so hampered by her safety devices as to have little or no military efficiency. In the opinion of Messrs. Siebe & Gorman it is essential that the salvage of the vessel and of the crew must be looked upon as entirely separate. Inevitable delays in the arrival of the salvage vessel and in getting purchase on, conditions of tide, weather, etc., render it almost certain that a submarine cannot be raised in time to save life.

It is taken for granted that an accident which will endanger the lives of the crew will result in the inrush of water in large quantities. A minor accident to the machinery would result only in an involuntary rush to the surface, owing to the reserve buoyancy of the boat, and any ordinary small leakage can be readily dealt with by the machinery at command.

When, however, there is a collision, or when, by some other mischance, a hole is made in the hull, the water enters freely, and the effect will be the descent of the vessel to the bottom. This may not be very fast, but, assuming that the water is entering more rapidly than it can be expelled the vessel will undoubtedly sink and continue to fill until she is either full, or, if not holed in the top, until the aid in her is compressed to a pressure equal to that of the water at the depth in which she has foundered. As soon as the salt water comes into contact with the battery or with the terminals of the dynamo, if this be still working, chlorine is evolved, and the air remaining inside is vitiated.

If anything is done, it must be done quickly. Accordingly, the following steps must be taken:

(a) To render the crew independent of poisonous gases,

(b) To preserve the crew from drowning in the boat, and

(c) To provide means of escape from the boat, and ascent to the surface.

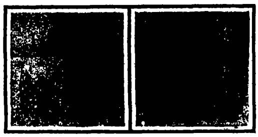
The devices to bring these about at present known are:

(1) Air locks for escape.

(2) Detachable chambers or life boats.

(3) Self-contained dress for escape.

Air locks alone are of little use except in shallow water, but combined with (2) or (3) are essential in all methods of escape. The air lock may be a portion of the boat provided for the special purpose, or the general cavity of the boat may be used, in which case the pressure inside the vessel can be made equal to that of the water outside by simply allowing the water to enter for it is manifestly impossible to open an aperture until the pressures at both sides of it are equal. The great objection to all forms of detachable chambers or life boats is their size, weight, and resistance. If made large enough to contain all the crew of a modern submarine, and as such a chamber would have to be carried as a superstructure, it would be in the likeliest position to be injured in case of collision. Moreover, what is further against any device of this kind is that the crew are expected in a moment of considerable excitement to undertake an entirely novel operation which there is no means of trying previously. Experience has shown that even plain drop safety weights fail at the critical moment.



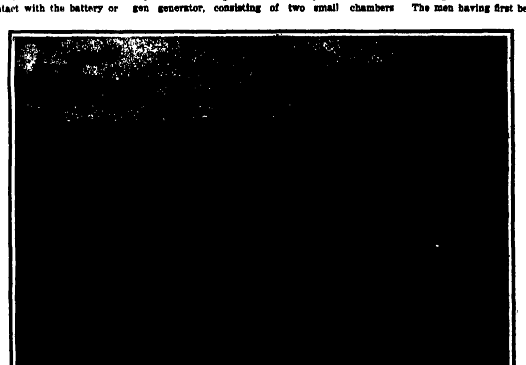
The diagram on the left shows a longitudinal section of a submarine, showing an air trap in use, three men under the trap in safety helmets, and one emerging from the conning-tower; that on the right a transverse section of a submarine, showing air-traps in use, men seated in the air traps, wearing safety-helmets, and a man emerging from the conning-tower.

VARIOUS METHODS OF ESCAPE.

A life-saving device to be efficient must be able to fulfill promptly the three conditions, a, b, and c, previously referred to, and in order to meet them a special form of diving helmet has been designed by Messrs. Siebe & Gorman which is quite self-contained and not dependent on any feature which is liable to get out of order. The helmet, which is large enough to allow the head free movement, is sloped away to fit the shoulders, and is connected to a short jacket of strong waterproof material. In front of the jacket, inside, is a pocket containing a combined air purifier and oxygen generator, consisting of two small chambers formed in one case. These chambers are charged with a patented substance which, when in contact with the water vapor of the breath, gives off pure oxygen gas and forms a caustic alkali. The alkali in its turn takes up the carbonic acid gas of the respired air and forms an alkaline carbonate. In this way, as in various types of smoke helmet, the same air, purified and re-oxygenated, is used over and over again. The total weight of the whole outfit is 16 pounds. Folded up for stowage, it occupies a space of 12 inches by 12 inches by 15 inches. The dress can be put on without assistance in 30 seconds. When on it prevents a man from drowning, and in proof of this it may be said that it is now in everyday use under water with perfect success. Moreover, it acts as a life buoy, and actually raises its wearer to the surface. An additional device is also fitted to enable the wearer when he reaches the surface to inflate a flexible chamber which surrounds the jacket and thus to form a life belt. This provision is necessary, for the length of time the purifier will remain in action is limited, and when its efficiency is impaired the door in the helmet must be opened, which operation can be performed by the wearer, in order to admit fresh air. When this is done the helmet ceases to be buoyant. Other methods, such as the fitting of cork belts or chambers already filled with air, have been tried and abandoned, being found to be impracticable, owing to the necessity of employing heavy weights to keep the wearer down, and also by reason of the dangerous velocity with which he would rise to the surface on the removal of the weights.

At Portsmouth the British Admiralty have in use a huge water tank, at the bottom of which is erected a skeleton submarine boat, serving the purpose of permitting the men to exercise in the helmet described. The men having first been trained to put on the dress quickly are set to practice getting into and out of the air lock. They are afterward lowered in the air lock to the bottom of the tank, where they enter the submarine, and find their way to a ladder leading to the conning tower, the hatch of which they open. They then either float to the surface or return to the starting point, the operations being repeated until the officer in charge considers the men proficient. These arrangements have been designed to represent as nearly as possible the same conditions as would obtain in a submarine boat that had been flooded.

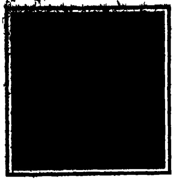
If the hole in the submarine be at the top, the water will gradually displace the whole of the air. If, however, the hole is below the top, then the water will only enter until the air, which cannot escape, has been compressed until its pressure is equal to that of the water outside. In the latter case there is no difficulty in getting at and putting on the helmet dress, since there is air inside the hull. In the former case, however, unless some special provision were made, this would not be so, and, accordingly, bulkheads are arranged to trap the air. The dresses are kept hanging up in readiness in the air pockets so formed. This does not in any way affect the habitability or efficiency of the vessel. It is claimed, further, that the [illegible]



By courtesy of Illustrated London News.

The boat having sunk to the bottom, air will be compressed either under the deck of the vessel itself or under the air-traps. Beneath the air-traps the men, having put on their special diving-helmets, sit, with their heads in the compressed air, until it is their turn to escape, either through the conning-tower or through the [illegible] and rise to the surface. In front of each waterproof jacket, attached to the diving-helmet, is a pocket containing a combined purifier and oxygen-generator, which enables the same air, purified and re-oxygenated, to be used [illegible] and again. The dress, which can be put on in thirty seconds, not only prevents the suffocation of the [illegible] acts as a lifebuoy. There are fitted to the air-traps air-supply pipes from the boat's compressed-air [illegible] that an extra pressure of air may be turned on when necessary. The drawing shows men, wearing [illegible] waiting under an air-trap in a submarine; men leaving the air-trap to ascend the conning-tower; a man leaving the conning tower to float to the surface, and a man escaping through the torpedo-hatch.

HOW MEN ESCAPE FROM A SUNKEN SUBMARINE.



ARTIFICIAL RADIUM BATHS AND DRINKING WATER

BY DR. ALFRED GRADENWITZ

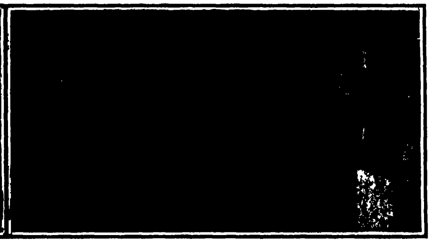
Until quite recently the curative effects of mineral waters were ascribed to the chemical substances held in solution. The lack of mineral solvents in some waters of remarkable therapeutic value could not be explained on this principle. Moreover for some unaccountable reason it was observed that most waters lost their healing properties when taken at some place distant from their source.

All these contradictory phenomena can now be plausibly explained by ascribing part if not all of the curative powe to radioactive s be anc s In fa t early all mineral waters have been found to contain radioactive emanation. This emanation being an extremely unstable body most waters lose their activity in a few days so that the cura ive ag nt canno exert its action unless the water be administered as soon as possible after issuing from the ground. Only a few waters containing radioactive substances capable of giving off a coi stant supply of e nana i n lav been found to keep at least part of th ir a ivity for a y length of time.

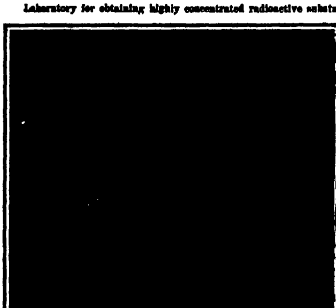
This tra ing of effi a y o rad oa i y a ra y suggested the artificial control of rad a iv y so as to impart curative effects to ina wa o o crease the efficiency of natural sp ings. The i1 a of adding variable amounts of emanation has been car

(Continued on page 468.)

Laboratory for obtaining highly concentrated radioactive substances.

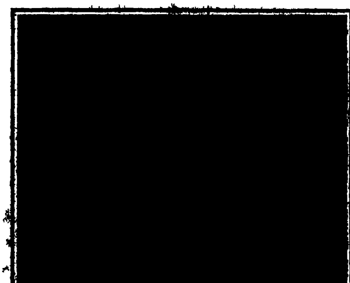


Laboratory for coarse chemical processes.



Washing plant for radioactive substances treated by chemical processes.

General view of the famous Kreuznach valley.



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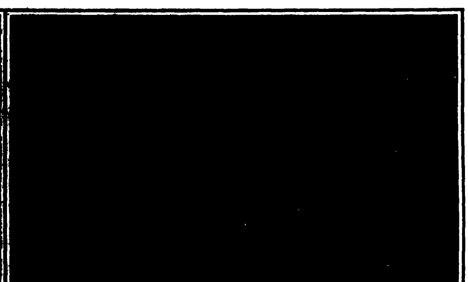


Mother liquor shipping room.

ARTIFICIAL RADIUM BATHS AND DRINKING WATER.

ALEXANDER GRAHAM BELL AND THE TELEPHONE

THE STORY OF A GREAT INVENTION

The telephone was first introduced to the public in 1876, and put to the first practical or commercial use in 1877 During that year was organized the first association or company to hold the patents The first companies which systematically exploited the business were formed in 1878, one for New England and one for the rest of the United States and Canada. These two companies succeeded to all the rights and property of the original association The capital represented $750,000 the value of the patents, and $100,000 in cash. Early in 1879 these two companies were consolidated into one company called The National Bell Telephone Company, the first company to attain any prominence The capital of this company was $850 000, deposited among 8 500 shares of $100 par value each The sum of $650,000 in shares was given, share for share, for the stock of the two old companies, and $200 000 in shares was left in the treasury This treasury stock was sold for the best price obtainable, as the money was required and yielded eventually $480,000 in cash The last 500 shares of this treasury stock sold for $600 each In the fall of 1879 a settlement was effected with the Western Union Telegraph Company, whereby the most formidable and powerful competitor was removed from the field Then it was that the stock boomed. The $100 shares, of which there were only 8,500, were quoted at one time at $1,000, although that price was probably never actually paid At the highest quotation, a total market value of all the shares of the company would have been $8,500,000 According to popular belief, twelve of the original investors have been credited with realizing if not more, at least as much as this, yet no dividends were paid by this company

Because of the rapid increase in business, more capital was required, hence in 1880 the American Bell Telephone Company was organized and the business of the National Bell Telephone Company transferred to it The shareholders of the National Bell Telephone Company were given for each share of their stock six shares of the new American Bell Telephone Company's stock At the same time, 8 500 shares of the treasury stock were sold at par In 1881 the first dividend was paid

The American Bell Telephone Company continued in business until 1899 during which time the capital stock had increased from $5 950,000 to $25,886,300 When the American Bell Telephone Company transferred its business to the American Telephone and Telegraph Company, there had been over $28,000,000 actual cash paid into the treasury of the company by the shareholders as against $25,886,300 capital outstanding During the time no stock dividend or a dividend of surplus in cash to pay for stock issued was paid The market price of the American Bell Telephone Company's shares during the year ranged above $200 a share, and the company was paying 15 per cent dividends yearly

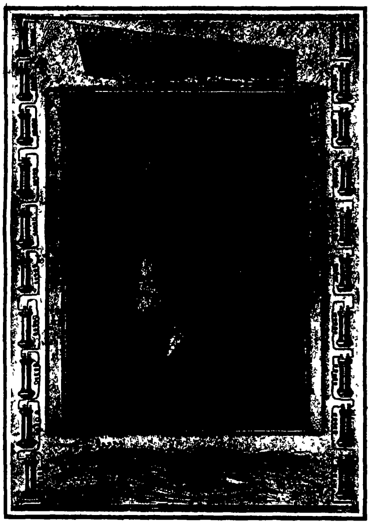
The demands of the business required much larger capital than could be provided under the corporate powers of the American Bell Telephone Company Hence, the American Telephone and Telegraph Company was organized to operate the long-distance traffic, and to it the business was transferred in 1899 The dividends were put on a 7½ per cent basis, and were increased in 1906 to 8 per cent, at which rate they still continue. Since 1900 the stock of the American Telephone and Telegraph Company has been increased from time to time as the business called for money At the close of 1909 there were in the hands of the public $206,474,300

This tremendous industry is the fruit of Mr Alexander Graham Bell's indomitable and persevering work as a young man His story of the invention of the telephone is a story of patient endeavor and experiment, continued for years in the face of many difficulties. He approached the subject more or less an expert in speech, for both his father and grandfather had been teachers of articulation and the laws of speech, and he had himself been educated to follow in their footsteps. In boyhood he constructed a talking machine At the age of eighteen he made discoveries which he thought original concerning the part played in the production of vowel sounds by the resonance of the cavities of the mouth. It was not long before he learned that Helmholtz had not only made the same discoveries, but had produced the sounds of the vowels by combinations of tuning forks, operated by electro-magnets. In order to repeat Helmholtz's experiments, Bell began to study electricity In 1872 he constructed an experimental apparatus in which each transmitter consisted of a tuning fork with its prongs between the poles of an electro-magnet. Current was applied intermittently by means of a wire which was attached to one prong of the fork and alternately made and broke the contact with a cup of mercury as the fork vibrated. As the prongs of the fork were attracted by the magnet each time the current was applied, the fork was kept continuously vibrating and sounding By pressing a telegraph key, the intermittent current was sent through the line wire to the receiving instrument, which consisted of another electro-magnet and tuning fork If the receiving fork was exactly in unison with the transmitting fork it was also thrown into vibration, but if it was not in unison it remained silent, because the portional currents did not reach it with the proper frequency to cause it to vibrate It was Bell's idea to use several transmitting forks of different pitches, and as many receiving forks of the same pitches. As each transmitter would affect only the particular receiver that was in unison with it, a number of telegraphic messages could thus be sent simultaneously over a single wire. Afterward Bell substituted for the tuning fork a steel plate or reed, with one end clamped and the free end very near the poles of the electro-magnet. The transmitting reed, like the tuning fork which it superseded, definitely made and broke contact, and thus made the current intermittent, and the receiving reed vibrated energetically only when it was in unison with the transmitting reed Still later Bell conceived the idea of polarizing or magnetizing each reed by clamping it to a pole of a permanent magnet, allowing its free end to project, as before, over the poles of the electro-magnet. He knew that the vibration of the magnetized reed would induce currents in the coils of the transmitting electro-magnet and that these currents, reaching the receiving electro-magnet through the line wire, would set the reed of the receiver into vibration if the two reeds were tuned to exact unison. This arrangement dispensed with the galvanic battery and the mercury circuit-breaker. The circuit was never broken and the current, instead of being intermittent, was undulatory, varying in intensity and direction in exact accordance with the motion of the transmitting reed. The two instruments were exactly alike, and either could be used as the transmitter. Several such pairs of instruments, of different pitches, could be employed, with a line wire connecting the two stations, and the plucking of any reed, at either station, would theoretically cause the reed of the same pitch, and that reed only, to "speak" at the other station, so that a number of messages could be transmitted simultaneously in each direction Bell, however, thought that the currents thus generated by the vibration of the reeds would be too feeble for practical use in multiple telegraphy and he therefore turned his attention to a system which included a battery and a mechanical circuit breaker

Meanwhile, in connection with his professional work, the instruction of deaf mutes and their teachers, Bell had been experimenting with the phonautograph, an instrument devised by Leon Scott for making visible records of the vibrations of sound. The short arm of a light wooden lever was attached to a membrane stretched over the small end of a funnel, and the long arm terminated in a bristle which touched a sheet of glass, covered with lamp-black, which was drawn along at a uniform speed. When a sound was uttered into the funnel the sound waves caused the membrane to vibrate and the bristle to trace on the smoked glass a sinuous curve, which represented the vibration so exactly that not only every pitch but every quality of voice, and each of the vowel sounds, produced its characteristic tracing. The principles of the phonautograph is almost identical with that of the phonograph Bell discovered defects in the instrument, and as he labored to remove them, it occurred to him that the best form of phonautograph would be an imitation of the human ear, in which the sound waves are likewise received by a membrane, the ear drum, and the vibrations are transmitted to the inner ear by a series of bone levers. Dr Blake, an aurist to whom Bell applied for precise information concerning the structure of the ear, suggested the employment of a real human ear instead of an imitation An anatomical specimen was prepared, with a fine straw attached to one of the bone levers to serve as a writing point, and Bell experimented with it in 1874, while he was still working with his reeds and electro-magnets

Another possibility had occurred to him. He knew that when a vowel sound is sung into an open piano all the strings that correspond to the overtones, which give the sound its vowel quality, as well as the string corresponding to the fundamental tone, are set into vibration, so that the piano repeats the particular vowel uttered. In like manner, the transmitting reeds, if sufficiently numerous, might take up from the air the component simple vibrations of a vowel sound and transmit them by means of the electro-magnets and the line wire to the receiving reeds, which would reproduce the vowel sound at the distant station Bell also considered the possibility of employing, at each station, one large electro-magnet instead of many small ones, in connection with all of the reeds, and thus combining the elementary electrical vibrations, corresponding to the components of the aerial sound waves, in the coil of the electro-magnet, instead of in the line wire. "In this way," the inventor has said, "I realized in the summer of 1874 the conception of a speaking telephone, and the apparatus is the first form of speaking telephone that occurred to my mind." But it seemed impracticable to construct an apparatus with a sufficient number of reeds, and so that "harp" telephone was never realized. Then it occurred to Bell that the resultant electrical effect in the coil of the electro-magnet might be produced by a single reed, if this reed could be formed to move in accordance with the resultant sonorous vibration. While studying this problem he was experimenting with the phonautograph made from a human ear. He was struck with the lightness of the ear drum in comparison with the weight of the bones moved by it, and it occurred to him that a larger membrane might operate a piece of steel in the [illegible] [illegible]. [illegible]

[illegible]



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ALEXANDER GRAHAM BELL.

A MOTION APPARATUS FOR AMATEURS

AN INGENIOUS FRENCH INVENTION

The production of photographs of moving objects has hitherto been denied to amateurs, for various reasons. It requires complicated and costly apparatus and delicate manipulations which cannot be performed without special appliances.

A simple apparatus, called the Cinephote, has been devised to obviate these difficulties and to put motion photography within the power of every amateur photographer, at least to the extent of producing animated portraits of his friends and his children, for the Cinephote does not pretend to vie with the elaborate apparatus by which thousands of instantaneous photographs of a long and complex scene are impressed on hundreds of feet of film.

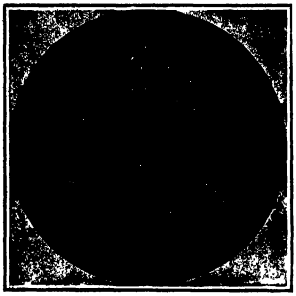


Fig. 1.—Disk with 24 pictures.

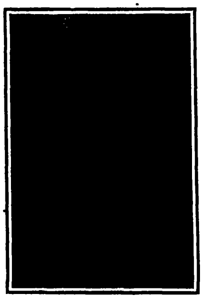


Fig. 2.—Watching the motion pictures.

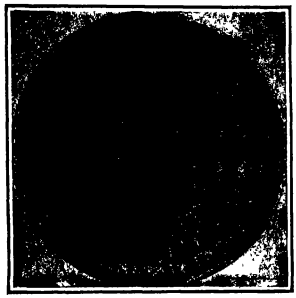


Fig. 3.—Disk with 75 pictures.

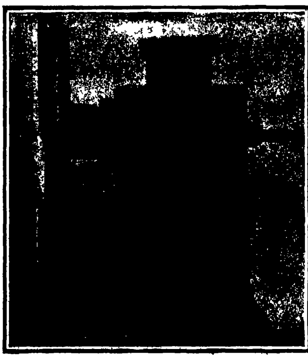


Fig. 4.—Apparatus for projecting the motion pictures.

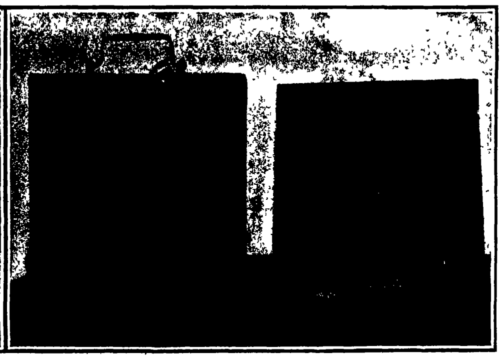


Fig. 5.—Cinephote camera and plateholder.

A MOTION APPARATUS FOR AMATEURS.

The Cinephote comprises two distinct pieces of apparatus: one for making the pictures, the other for exhibiting them in such a manner as to give the illusion of movement. Both of these devices work automatically, by means of very simple mechanism. The negatives, which are either 24 or 75 in number, are made on a circular sensitized plate, on which the 24 pictures are arranged in the form of a circle, while the 75 pictures are arranged spirally, as the accompanying illustrations show. In either case, the disk is perforated with small holes, equal in number to the pictures, and distributed at equal angular distances along the same curve—circle or spiral. By means of a larger hole at its center, and a corresponding peg, or bearing, in the plateholder, the disk is secured in the latter in such a manner that it can turn freely about its axis. The pressing of a button then releases a pin, to which a [illegible] horizontal movement is imparted by [illegible] and which, engaging successively with the small perforations, causes the disk to rotate intermittently, pausing after each advance long enough for a single exposure. At the same time the shutter is automatically caused to open when the disk stops and to close when it resumes its rotary movement. For the disk containing 24 pictures arranged in a circle, the bearing is fixed at the center of the plateholder, but for the disk with 75 spirally arranged pictures, the bearing is free to move in a vertical slide and, as the reciprocating pin engages successively with the spirally arranged perforations, the disk is displaced in such a manner that each picture is made in its proper place in the spiral curve. In either case the movement of the mechanism is automatically arrested when the entire series of photographs has been made, so that double exposures are prevented.

The lens of the Cinephote is either a "Graphor," which is corrected for astigmatism, and can be used with a stop of F/6 and produces satisfactory outdoor views in most weather conditions, or a "Eurygraph" anastigmat, which is very well corrected for spherical and chromatic aberration and gives perfect definition with a stop of F/2.8.

As there is no rigid connection between the disk and the mechanism, either single or double plateholders, or even a magazine camera, can be employed.

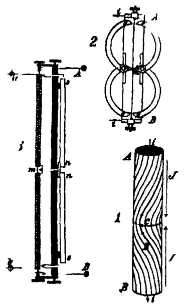
The negatives are developed in the ordinary manner, with the aid of a specially constructed printing frame, and [illegible] are made [illegible] which have perforations corresponding to those of the negatives. The moving scenes are reproduced and presented to the eye (assisted by a magnifying lens) by means of an automatic mechanism driven by clockwork and essentially similar to the mechanism employed in making the negatives. But, as only a very fleeting illusion is thus produced by the disks which contain 24 pictures, there is provided, for these disks alone, another apparatus which can be turned by hand, slowly and for an indefinite time, showing the pictures repeatedly in their proper order. A third form of apparatus is furnished for the purpose of projecting the pictures on a screen with a lantern.

A writer in a contemporary refers to numerous failures of cast iron fittings which were, however of the usual run of commercial extra heavy fittings of which neither the metal nor the thickness were sufficiently good. The growth of cast iron under repeated heating is discussed and reference is made to Outerbridge's work. Steel fittings have also failed, within the author's experience only four out of twenty five steel gate valves, 6 inches, 8 inches, and 10 inches in diameter, were fairly tight after one year's service. A thoroughly sound steel casting can withstand highly superheated steam, which does not initiate defects but rapidly develops them. Gun iron is high grade cast iron having a tensile strength of 30,000 pounds or more, and is adapted for 180 pounds of steam with 300 deg. F. superheat. Analysis of various specimens of iron which failed under 250 deg. superheat are given, but the following successfully withstood 300 deg. superheat for four years: Silicon, 1.72 per cent, sulphur, 0.085 per cent, phosphorus 0.89 per cent, manganese, 0.48; total carbon, 2.45, combined carbon, 0.17. Low silicon, phosphorus, and carbon characterize it.

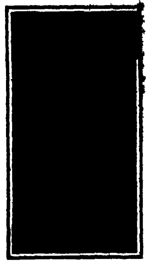
AN INGENIOUS TORSIONAL WAVE DETECTOR

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN

Prof A G Rossi of the Royal Polytechnic Institute of Turin has devised a new form of detector for use in wireless telegraphy which is of special interest because of the novel principle it employs He uses the property known as magneto striction found in iron or nickel wires A fine iron wire stretched in a magnetic field is found to lengthen at first and then shorten according to the strength of the field the value effect being about 1 400000th of the length of the wire The inventor sought to increase this effect and to apply it to a detector for waves The principle of the apparatus is shown in Fig 1 A fine iron wire is stretched in a vertical position between two fixed points A B Two constant magnetic fields formed by two equal bar magnets magnetize the wire in two halves in the opposite sense with the intensity J J and longitudinally as shown by the arrows At the same time a current is sent through the wire from t to t and this gives a circular magnetization to the wire with an intensity The result of the combined magnetic fields will be a magnetization of helical form I Owing to the effect of magneto-striction the wire will have a torsion represented at C in the direction of the arrow, this being what is known as the Wiedemann torsion effect. Leaving the longitudinal field as it is if we reverse the current in the wire the torsion effect will be also reversed When we send an alternating current through the wire we have a strong effect of vibration as the torsion is also alternating in its sense A mirror placed at the middle of the wire is made to reflect a beam of light on a screen and the spread of the beam shows the amplitude of the vibration The effect is much stronger when the period of the alternating current is of the same value as the normal vibration rate of the wire, and we have a much longer line of light on the screen The wire is of about 0 02 millimeter diameter, and is held under tension between two light springs mounted on an insulating plate Fig 3 shows the arrangement, and the springs are coupled to the binding posts A B Near the ends and at the middle of the wire project three iron points which come from the bar magnets n s n s so as to guide the magnetic flux into the wire This latter is stretched inside a glass tube of small diameter leaving a gap at the center for the mirror m A spiral of insulated copper wire is wrapped about the glass tubes with the two halves coiled inversely and the current comes from a and b into the wire The copper spiral is designed to receive the waves from the antenna and it acts to modify the effect which we have seen above to be given by the combination of the alternating current and the bar magnets in the wire When no waves are received we have a constant torsion effect in the wire, that is a constant rate of vibration When on the contrary the wave effect occurs in the copper spiral the rate of the vibration is modified and the line of light on the screen is changed The terminals a b are connected to a pair of vertical antenna wires which are insulated from ground All the rest of the apparatus is held insulated on a glass tube support 5 feet from the floor Light for the beam is given by a Nernst lamp and the same alternating current circuit is used for exciting the wire using the proper means to secure a very small current through the wire The copper spiral is joined at the top to the antenna and at the bottom to ground With such an arrangement the instrument shows the effect of waves received from a distant station and we notice variations in the beam of light due to this cause It is designed especially to be used for receiving signals formed by a succession of waves, such waves to follow each other in series so as to form periods of low frequency The frequency is first adjusted so as to be the same as that of the vibrating wire Besides the tuning of the high frequency waves, this allows us to use a second, or local tuning of the low period waves It should be remarked that Prof. Rossi's instrument transforms directly an electric vibration of low frequency into a mechanical vibration and contrary to other detectors, there is no transformation of energy between the effect of the same and the registered optical indication It is thus extremely sensitive To have a permanent record of the signals, the author proposes the use of a photographic band descending in front of the beam and as the variations of the lat ter are sidewise, we would have a set of wave-like signals printed on the band By using a selenium cell which is lighted by the beam we could work a Morse register with the instrument, provided a strong enough light is reflected by the mirror on the cell Owing to the sensitiveness of the instrument there is no doubt that it can be used with a much less expenditure of power at the sending station On the other hand it simplifies the apparatus which is needed at the receiving station An alternating current generator is not required in this case, but a simple vibrator will give the needed impulses for exciting the stretched wire



How the torsional effect is produced



A detector which transforms electrical wave trains into mechanical vibrations.

THE HEIGHT OF THE ANTARCTIC CONTINENT

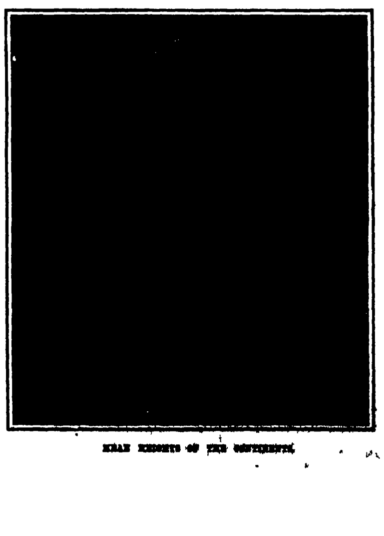
BY WALTER LANGFORD

Our knowledge of the Antarctic continent is daily becoming more precise Soon after Shackleton's memorable dash toward the South Pole had furnished very important data in regard to the interior of the continent Charcot's voyage supplied valuable additions to our knowledge of the boundaries of this vast territory The French expedition succeeded in surveying accurately a great many miles of coast line that had previously been entirely unknown or only conjecturally laid down

The results of these expeditions prove that the mass of land accumulated about the South Pole is even greater in comparison with the other continents than had previously been supposed The elements involved in this comparison include an estimate of area and a determination of the heights of the mountain masses Both of these elements require exact and comprehensive surveys The problem was first attacked by Humboldt at an epoch when our knowledge of the earth was very incomplete Hence Humboldt's estimates of the mean elevations of the known continents above the sea level are far too low This mean elevation is the height of a fictitious plateau obtained by distributing the mass of the continent uniformly over its surface i e it is the quotient obtained by dividing the volume by the area Humboldt's estimates of the mean elevations of continents are Europe 6 " feet North America 748 feet South America 1151 feet Asia 1151 feet entire known land surface of the globe 1 004 feet Except in the case of Europe these values differ enormously from the more recent estimates given below This discordance shows the necessity of thorough exploration and accurate surveys although a general estimate can be obtained from elements of a totally different character as we shall see in connection with the Antarctic continent Kruemmel who was the next after Humboldt to attack the problem estimated the mean elevation of the entire known land surface of the globe at 1 443 feet, a value which was still far below the truth The later estimate of Lapparent, based on more complete data was 2,000 feet, or more while the more recent estimates of Murray Penck, Lupan and De Lillo are still higher Murray's values as revised by Penck are Europe 918 feet Australia 918 feet, North America, 1,968 feet, South America, 2 066 feet, Africa 2 132 feet, Asia 3 116 feet general land surface, 2 312 feet From these values which appear to be very nearly correct, the total volume of the continental masses is computed to be about twenty-four million cubic miles

All of these estimates relate only to those parts of the world that were known at the epochs when the various estimates were made The recent Antarctic explorations have entirely changed the face of the problem and have raised the Antarctic continent to the first place which was formerly occupied by Asia. The exact and extensive knowledge which we now possess in regard to the other continents is still lacking in the case of the Antarctic, of which we know only the few points that have been reached by the expeditions.

Meinardus has endeavored to determine the height of the Antarctic continent from meteorological data. With the distribution of atmospheric pressures and the ...



MEAN HEIGHTS OF THE CONTINENTS

CURIOSITIES OF SCIENCE AND INVENTION

MOVING A TOWN BY RAIL.

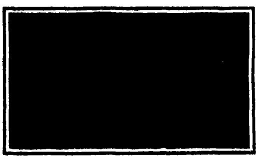
Pictured herewith is a trainload of houses on the Weatherford, Mineral Wells & Northwestern Railway in Texas. There are five flat cars loaded with miners' cottages of two rooms each, each room being 12 by 14 by 9 feet. Extreme height above the car is 15 feet 4 inches. In addition there are two cars containing the

A TRAINLOAD OF MINERS' COTTAGES.

lean-to kitchens, and two cars that carry other wreckage of the coal-mining town of Rock Creek, Texas, whose mines were abandoned. The train was moved successfully at the rate of 15 miles per hour, and around a number of six-degree curves having the outer rail elevated four inches.

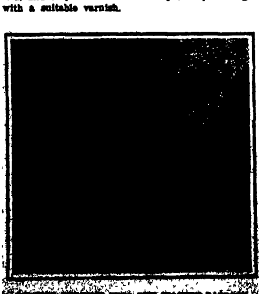
WOODEN FRAMES FOR AIRSHIPS.

When the Zeppelin balloon was destroyed in a thunder storm two years ago it was asserted that a static discharge of electricity from the metallic frame of the balloon had ignited the gas. To obviate such an accident in the future, a German inventor has devised a balloon having a wooden frame, which he claims is



A BALLOON FRAME FORMED OF WOODEN STRIPS.

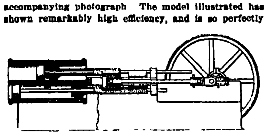
not only lighter than aluminium, but is stronger as well. A frame thus constructed was exhibited at the Frankfort Exposition last summer, and proved quite an attraction. The accompanying photographs show how the frame is made up in a network of wooden strips which is very strong and yet possesses a considerable degree of flexibility. The model illustrated is 65 feet long and 8 feet in diameter. The meshes of the network are much smaller than in the Zeppelin type of balloon, using aluminium framework. Accordingly, the wooden frame makes a more efficient support for the envelope of the balloon when the gas is expanded by the heat of the sun. Another advantage of the wooden frame is the fact that it can be repaired anywhere, whereas aluminium can be worked only with special apparatus and by an experienced workman. The wooden frame is not affected by heat or cold, and may be rendered waterproof by coating it with a suitable varnish.



[illegible] THE WOODEN BALLOON FRAME.

ENGINE WITH HEADLESS CYLINDERS.

In order to produce a completely-balanced engine, an inventor has recently adopted the unique plan of providing the engine cylinders with two pistons each. The steam enters between the two pistons, separating them. This renders the cylinder heads useless, for there is no reaction against them. One of the pistons is provided with a hollow piston rod to receive the rod of the other piston. The engine shaft is provided with two cranks at right angles to each other, which are respectively connected to the two piston rods. Thus a forward and backward impulse is given simultaneously by the steam entering one cylinder, and there is an equal distribution of the load. When the pistons reach the end of their stroke, steam is admitted to a second cylinder of the same type, which repeats the operation while the first cylinder exhausts. There are no jolts, strains or vibrations, as the forces are entirely absorbed in motion. The ends of the cylinders are preferably closed by suitable doors, to prevent dust or other extraneous matter from entering and choking or clogging the working parts. These doors are shown open in the accompanying photograph. The model illustrated has shown remarkably high efficiency, and is so perfectly



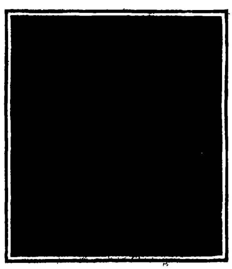
SECTIONAL VIEW SHOWING CROSS CONNECTED PISTONS.

A HEADLESS-CYLINDER BALANCED ENGINE.

balanced that it will run smoothly on the flimsiest of supports.

A NOVEL AUTOMATICALLY ADJUSTABLE ORGAN BLOWER.

A novel method of adapting electric motive power to organ blowing is shown in the accompanying engraving. The mechanism comprises an accurately turned hemisphere of aluminium driven by a small electric motor fixed to a bracket swinging horizontally on a vertical spindle. The hemisphere drives by friction an ordinary bicycle wheel fitted with a pneumatic tire, as shown in the illustration. There are the usual cycle chain and sprocket gear, for still further reducing the speed, and the final chain wheel transmits reciprocating motion to the bellows handle by means of a crank. There is no slip between aluminium hemisphere and the tire, owing to the elasticity of the air cushion, and as they are constantly in contact there is no wear. This ingenious little machine will blow a 16-stop or larger organ silently and with very high efficiency. It requires no attention, and current sufficient to run the motor is obtained by connection with an electric lamp socket. As it is practically silent and occupies a surface of only 45 by 16 inches and is 23 inches in height, it can be placed on the floor beside the instrument. The speed of the motor is constant, but automatic control of the pumping is provided by a chain connection between the swinging bracket and organ reservoir or bellows. By means of this chain the motor and hemisphere may be drawn through an arc of 90 degrees into the position of full organ, while a spiral spring returns them to the neutral position, as shown in the illustration. The rising and falling of the reservoir thus cause the speed of the bellows handle to vary from zero to maximum, and keep the bellows full automatically.



NOVEL ELECTRIC ORGAN BLOWER.

The speed is regulated by a swinging hemispherical friction wheel.

A NOVEL PADDLE FLYING MACHINE.

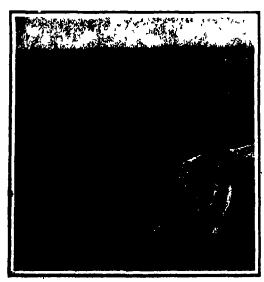
The peculiar flying machine illustrated herewith was one of the novelties at the Olympia Aero Show held recently in London. It is the invention of Messrs. Wyllie and Ottino, and consists of a large number of small planes arranged in an endless band and driven somewhat after the manner of a tread mill, the idea being that as these planes move along from one end of the machine to the other at a rapid rate they produce

FLYING MACHINE WITH A TRAVELING CHAIN OF LIFTING PLANES.

a lifting effect owing to the slight angle to the horizontal at which they are set. As they move around at one end in passing from the bottom to the top they are at an angle to the horizontal and still produce a lift, while as they descend at the other end their downward movement produces a lifting effect. The machine was exhibited without a motor but this fact did not detract from its novelty. The idea of the moving planes is that the flying machine will lift itself directly in the air and that no forward motion over the ground will be required.

A SERPENTINE WHARF.

One of the longest wharves in the world, almost a mile in length, or to be exact, 4,700 feet, is at Port Los Angeles, Cal. It extends into the Pacific in a long serpentine curve. The reason for this construction is that it offers better resistance to the strong currents and the buffetings of the waves than if it were perfectly straight. Until the nearby harbor of San Pedro was developed by the Federal government, the big wharf at Port Los Angeles was a very busy place, but of late it is comparatively seldom used except by the Japanese fishermen, who have formed a colony along the adjacent beach.



A SERPENTINE WHARF NEARLY A MILE IN LENGTH.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

BELT.—G. W. Ream and P. E. Green, Butte, Mont. In this case the object of the invention is to provide an extensible belt, which may be folded to form a belt of ordinary width, or unfolded to make a belt of varying capacity, in accordance with the contents to be contained therein and which in any position will be firmly secured together.

Electrical Devices.

LEVER CHECK FOR ELECTRIC CONTROLLERS.—J. Thomas, New York, N. Y. This invention refers to a device to be used as an attachment for controllers such as are mounted on electric cars for controlling the operation of the motors. An object is to improve the construction of the pawl so as to render it more efficient. Further to improve the means for resiliently constraining the pawl arm toward the segment and to improve the device in other details.

Of Interest to Farmers.

FEEDING ATTACHMENT FOR FANNING MILLS.—H. Dykstra, Spring Valley Township, S. D. The object here is to provide an attachment which can be removably mounted upon the fanning mill, which is adapted to feed fanning mills of different sizes and types by means of which grain and the like can be fed into the mill continuously and evenly, in which the rate of feeding can be exactly controlled, which is adapted for use with fine as well as with coarse grain, and which is simple to operate.

CLEVIS.—G. H. Johnson, Cimarron, New Mex. This invention is an improvement in the construction of the ordinary U-shaped clevis used on plows, cultivators, and harrows for the attachment of draft appliances. The head of the bolt is prevented from contact with other objects, which is very objectionable in clevises of the ordinary construction. In order to protect the head of the fastening device from contact with other objects, it may be arranged in a socket, so that when in locking position the head does not project above the clevis.

WATERING-TROUGH.—T. C. Tersroom, Ireton, Iowa. The aim of the inventor is to provide a simple, strong and durable watering trough, in which the flow of water is automatically regulated, so that the water will not exceed a certain predetermined height in the trough, and in which the flow of the water is positively controlled by the action of the float.

Of General Interest.

GLASS-DRAWING FURNACE.—I. J. Ralston and J. Briggs, Kane, Pa. An object in this instance is to provide a new type of furnace, readily accessible, and which will permit clean and uniform cylinders to be drawn therefrom. Further to provide a glass drawing furnace with means for protecting a plurality of baths therein and with means for framing and protecting a clean drawing surface.

CLOSURE.—C. D. Love, Newark, N. J. The purpose of the improvement is to provide a closure for use on bottles and other packages and arranged to insure perfect hermetic sealing of the package, by the use of a spring interposed between the cap and the closing disk and bearing annularly on the latter at a point opposite to the support for the closing disk.

WRITING TABLET.—R. C. Kuhn, Minneapolis, Minn. Among the principal objects in view in this invention are to provide an order book having a cover wherein is provided a pocket to contain envelops adapted for mailing the order sheets from which the said book is constructed and to provide a form of construction which is durable, simple and economical.

ADJUSTABLE RACK REVERSIBLE DEVELOPING TANK.—P. Y. Howe, Yonkers, N. Y. The purpose here is to produce a rack for holding the plates within the reversible tank, and to provide a construction for the rack which will enable plates of different sizes to be securely held. The rack involves a construction which permits the plates to descend to the bottom of the tank whether it is held in its upright or in its reverse position.

PASTE BOX.—O. Dakuss, Stroudsburg, Pa. The purpose of the inventor is to so construct the brush holder that the brush will be automatically raised from a substantially horizontal position to an inclined position, as the cover of the box is raised. This brings the handle of the brush to an elevated position above the top of the box so that it may be readily grasped ready for use.

DISPLAY APPARATUS.—E. F. Cannon, Portland, Ore. The object here is to provide an apparatus for exhibiting goods or wares, in which the goods are arranged upon carriages which travel successively and continuously in a plurality of directions and thus show the goods to the best advantage and from different sides, and in which the carriages are movably supported upon the floor, which, at the same time serves to conceal the mechanism for actuating the carriages.

ANIMAL TRAP.—P. J. Kottum, Sacred Heart, Minn. This trap is of the class that chokes the captured animal to death and the object is to provide a trap of this character that is simple, strong, easy to produce and which, when assembled presents a compact trap that is very effective and kills the animal without injuring its pelt.

Household Utilities.

STAND-BOILER.—W. Sherwood, New York, N. Y. The object of the invention is to provide a boiler, arranged to direct the hot water coming from the heater or water back of the range or furnace, into the top of the boiler, to prevent this hot water from being reduced in temperature by contact with the cold water entering the boiler shell from the water main or other supply at or near the lower end of the boiler shell.

CLOTHES LINE HOLDER.—A. Heininger, New York, N. Y. The invention relates to holders of the kind especially adapted for use in connection with buildings, the more particular purpose being to provide a holder having an arm mounted upon a window jam, or the like and adapted to swing for the purpose of affecting the condition of the clothes-line which is practically supported by the arm.

ELECTRIC COOK STOVE.—F. H. Zaiser, Detroit, Mich. This cooker is more or less analogous to a so-called "fireless cooker," and the aim is to fit within the same a number of electrically operated heating units for supplying heat to the stove. Heat is regulated by a proper distribution of the heating units, by cutting out a suitable amount of the resistance offered by the heating units themselves.

CHAIR.—W. S. Phillips, Cameron, W. Va. The invention is an improvement in chairs, and the object of the improvement is to provide a chair which will fold up under a table or other support out of the way, when not in use, by means of a spring and which may be easily drawn out into position when required, and will be locked in such position by its own weight.

Machines and Mechanical Devices.

LOOSE LEAF BINDER.—T. Brazil-Dibben, North Sydney, New South Wales, Australia. The object of the inventor is to provide a mechanism for the binding plates, which is arranged so as not to diminish the capacity of the case or frame or be injured when the clamping plates are fully moved apart and which extends longitudinally of the case to one end thereof at a point conveniently accessible for operation.

TIPPING FURNACE MIXER, ETC.—J. L. Klindworth, Bellevue, Pa. The improvement is designed to provide means of an efficient character for protecting the actuating screw from contact with dirt, molten metal, or other foreign matter, and further, to provide means of novel character for relieving the actuating screw and nut from vertical and lateral thrust and pressure.

AIRSHIP.—L. Arnheiter, Jersey City, N. J. The object of the inventor is to provide an airship or aeronef arranged to provide a large sustaining surface, and to permit of conveniently raising, lowering, propelling and steering the ship in any desired direction. The suspended car is preferably in the form of a boat capable of floating on the water if required, and to allow the aerial vessel to again rise from the water.

Prime Movers and Their Accessories.

CARBURETER.—G. E. Cook, New York, N. Y. One object in this case is to provide means whereby the opening of the throttle valve to bring an increased number of jets into operation, also operates to permit of an automatic dilution of the explosive charge in accordance with the suction pressure and speed of the engine.

ELASTIC FLUID MOTOR.—J. L. Shirley, 2a Bucareli No. 800, City of Mexico, Mexico. This invention consists in an elastic fluid motor having a rotating distributing valve which is adapted by its rotation to supply working fluid to one or more cylinders and exhaust the working fluid therefrom in the proper sequence. It further consists in the improved distributing valve and valve gear.

Railways and Their Accessories.

STAND-PIPE FOR RAILWAY WATER SUPPLY.—P. H. Knight, St. Joseph, Mo. The principal objects here are to provide a construction of a pipe wherein the operative parts are constructed in a form light, strong and durable, to provide a construction wherein the usual splashing or loss of water incident to the operation of drawing same at the water stations is eliminated, to provide an operating mechanism which is compact, certain and easy of manipulation and to provide a construction adapted to compensate the disadjustment incident to employment in the ordinary service.

Pertaining to Vehicles.

CAR FENDER.—C. P. Bronson, Corning, New York. The invention is an improvement in fenders, more especially designed for automobiles, and has in view a comparatively light fender, which when in normal position, is compactly arranged and projects a relatively small distance beyond the front of the vehicle, and when striking a body, is automatically forwardly extended to receive and support the object struck.

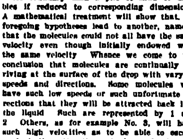
NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 18th, 1909, or will be sent by mail on request.

(12240) J. F. B. writes: In your issue of April 16th C. F. L. inquires for an explanation of the connection between curvature of surface and vapor pressure. The following is abbreviated from Millikan's "Mechanics Molecular Physics and Heat," price $1.65, and Watson's "Physics," price $3.50, together with a few wrinkles of my own. All matter is conceived by physicists to be composed of molecules whose shape is not definitely known. One of the most characteristic differences between a liquid and its vapor is that the molecules are close together in the liquid and farther apart in the vapor, somewhat as suggested by the diagram. A very essential part of this molecular theory is that the molecules are in motion, and because there is no friction between them, their motion does not die down because of collisions, merely rebounding according to the laws of perfectly elastic impact. Hence a drop of water has more of an exact boundary than a pile of sand or marbles if reduced to corresponding dimensions. A mathematical treatment will show that the foregoing hypotheses lead to another, namely, that the molecules could not all have the same velocity even though initially endowed with the same velocity. Whence we come to the conclusion that molecules are continually arriving at the surface of the drop with varying speeds and directions. Some molecules will have such low speeds or such unfortunate directions that they will be attracted back into the liquid. Such are represented by 1 and 2. Others, as for example No. 3, will have such high velocities as to be able to escape against the attraction of the molecules remaining in the liquid. These molecules which escape become a part of the vapor. The attraction which tends to prevent the escape and actually retards it, is otherwise called



cohesion, though merely gravitation at close range. Now let us consider the liquid at the different curvatures, as A, B, and C. Molecules 1 and 2 would return to the liquid in any one of the three cases, while molecule 3 would probably escape at the same time. Molecule 4 however would return to the liquid if the surface were at C, but would escape if it were at A or B, and molecule 5 would escape if the surface were at A but would return to the liquid if the surface were flat or concave. Therefore we feel at liberty to make the following statements: (1) That more molecules can escape per second from a convex surface than from a flat one, and (2) more from a flat one than from one that is concave. Since the vapor pressure at a given temperature for a given liquid depends on the number of molecules that can leave per second, we see that the vapor pressure of a convex liquid surface is greater than one that is flat or concave, and that the more convex the greater the vapor pressure. These conclusions have an interesting connection in the formation of rain. The microscopic drops constituting the clouds are not in all probability all of the same size, so that the small ones would have a tendency to evaporate and the vapor condense on the larger ones with a much weaker vapor pressure. Thus the drops grow until large enough to fall rapidly. After falling becomes quite rapid it is probable that collision with smaller drops is more efficient in increasing their size.

(12241) B. L. C. asks: Does air or other gas expand when heated in a closed cylinder sufficiently for the pressure to be increased, and if not, how is the pressure increased? A. Air cannot expand in a closed cylinder, if heated. The pressure rises because of the increase of heat energy which would cause expansion if the air were under only normal pressure and were heated. All gases act nearly alike in this respect. The expansion for a rise of temperature from 0 deg. C. to 1 deg. C. is 1/273, and so on for higher temperatures. Kent in his "Mechanical Engineer's Pocket Book" gives a table of pressures and temperatures up to 300 pounds pressure. At 300 pounds pressure the temperature of air not cooled is 372 deg. F.

NEW BOOKS, ETC.

THE ADVANCEMENT OF INDUSTRY. Being a Study of Certain Manufacturing Industries in India, With Suggestions for Their Development. By Henry Hemantakumar Ghosh. Calcutta, India: R. Cambray & Co., 1910. 8vo.; 233 pp.

The early years of the present century have witnessed the birth of a new era in India, which is likely to be remembered as much for the industrial awakening it has caused, as for the political aspirations it has aroused in the people. The author attempts to make some suggestions for the improvement of native industries. The illustrations are awful; we have almost never seen such cuts in any printed book. It is not likely that the book will be of much interest to American readers.

SOLID BITUMENS. Their Physical and Chemical Properties and Chemical Analysis. Together with a Treatise on the Chemical Technology of Bituminous Pavements. By S. F. Peckham, A.M. New York and Chicago: Myron C. Clark Publishing Company, 1909. 8vo., 324 pp. Price, $5.

The literature of bitumens is rather limited, therefore the present volume will prove of value. The titles of the chapters are as follows: Geographical Distribution of Bitumens, Origin of Bitumens, The Classification of Bituminous Substances, The Derivation of Natural Solid Bitumens, The Derivation of Bituminous Rocks, The Derivation of Artificial Solid Bitumens, General Considerations Concerning the Chemistry of Solid Bitumens, Boussingault's Memoir Upon the Composition of Bitumens; The Use of the Words, Petrolene, Asphaltene, etc., The Ultimate Analysis of Solid Bitumens; The Proximate Analysis of Solid Bitumens, The Technical Analysis of Solid Bitumens, Special Chemical and Physical Methods of Analysis by Which Solid Bitumens May be Recognised and Distinguished, Miscellaneous Methods Applied to Street Mixtures and Surfaces, Bituminous Paving Blocks, Bituminous Concrete, Wood Paving Blocks, Cements, Cement Mortars and Concrete, etc., Specific Gravity, etc., Historical Introduction, A Modern Street, Bitulithic Streets, The Oiled Roads and Streets of the Pacific Coast, Asphalt Blocks, Wood Blocks, Conclusions.

PATTERN MAKING. By H. Willard. Chicago: Popular Mechanics Company, 1910. 12mo., 214 pp. Price, $1.

This book contains chapters on core making and molding. It is written by a practical pattern maker of long years' experience. The information given appears to be of a very practical nature, and the book will undoubtedly prove of value.

PRACTICE AND THEORY OF THE INJECTOR. By Strickland L. Kneass, C.E. New York: John Wiley & Sons, 1910. 8vo., 175 pp. Price, $1.50.

Since the publication of the second edition, there have been marked changes in the construction of locomotives which have reacted upon the method of feeding boilers and consequently upon injector design. Many of the heavy articulated types have no available space within the cab for an injector of the required capacity, so that the trend is again toward the non-lifting form. Further, motive power officials are recognising the advantage of utilising waste products for heating the feed water, and purifying it of scale bearing salts, and are giving more attention to the details of boiler feeding accessories which make for economy of operation as well as for the safety of passenger and employee. Owing to the development of the steam turbine, a large amount of experimental work has appeared in technical journals in connection with the flow of steam. It is gratifying to the author that these late investigators confirm his experimental work, first published in 1891, extracts from which are given in the text.

MOSQUITO OR MAN, THE CONQUEST OF THE TROPICAL WORLD. By Sir Rupert W. Boyce, M.B., F.R.S. New York: E. P. Dutton & Co., 1909. 8vo.; 267 pp. Price, $3.50 net.

The author has purposely selected the title "Mosquito or Man" in his endeavor to epitomise in one the tropical-medical movement which is now spreading all over the civilized world. Large numbers of well-equipped medical men have been sent to the tropics. Vast mines of literature dealing with tropical diseases have been distributed, and the public has been steadily educated to understand that it is not impossible to make the tropics healthy. The author shows that the [illegible] diseases of the tropics which were the greatest enemies that mankind has ever had to contend with, namely, malaria, yellow fever, and the sleeping sickness, are now fairly in hand. The tropical world is unfolding once more to those who do not now dread the [illegible] hand of death as did the men of old. The book is admirably printed and is beautifully illustrated.

THE COPPER HANDBOOK. A Manual of the Copper Industry of the World. By Horace J. Stevens. Houghton, Mich., 1909. 8vo.; 1,[illegible] pp.

[illegible]

... properties of the world. The copper mines in various countries are dealt with, and there is an excellent glossary. There are also chapters on the uses of copper; substitutes for copper; brands and grades of copper, alloys of copper; electro-metallurgy of copper, pyro-metallurgy of copper; hydro-metallurgy of copper; milling and concentrating of copper, mining of copper; chemistry and mineralogy of copper, geology of copper, etc.

AMERICAN GAS PRODUCER PRACTICE AND INDUSTRIAL GAS ENGINEERING. By Nisbet Latta. New York: D Van Nostrand Company, 1910 4to., 459 pp Price, $6 net.

Producer gas is gaining in favor each year in the United States, and it will take some time before there is an adequate literature relating to it The present volume goes a long way toward filling a vacant niche. The author is thoroughly acquainted with his subject, as is shown by the handsome piece of book-making before us. The chapters deal with Producer Operation, Cleaning the Gas, Works Details, Producer Types, Moving Gases; Solid Fuels, Physical Properties of Gases, Chemical Properties of Gases, Gas Analysis, Gas Power, Gas Engines, Industrial Gas Applications, Furnaces and Kilns, Burning Lime and Cement, Pre-Heating Air, Doherty Combustion Economiser, Combustion in Furnaces, Heat, Temperature, Radiation and Conduction, etc. The book has 247 illustrations.

PRACTICAL DYNAMO BUILDING FOR AMATEURS. By Arthur J. Weed. New York Norman W Henley Publishing Company, 1910 12mo.; 83 pp., 64 illustrations Price, $1 in cloth, 50 cents in paper

Practical directions are given in this work for the construction of a small dynamo of the type particularly adapted for use in manual training schools and State colleges The dynamo has a capacity of 50 watts, and weighs but a little over five pounds, so that it is of convenient size for use in a class room or in a lecture hall, where it can be passed around for purposes of illustration. This little machine has been successfully used for furnishing current to spark coils. In a large New England wire mill a dozen of these machines have been used as motors for spooling fine copper wire.

THE BOY AVIATORS IN NICARAGUA. By Captain Wilbur Lawton New York Hurst & Co, 1910 12mo; 336 pp Price, 35 cents.

This book is nothing if not up-to-date. It takes up a most exciting story of a most impossible nature, in which two boys who have built an aeroplane become involved in the revolution of Nicaragua Their exciting adventures with a general of the Nicaraguan forces who is bent on their destruction, and also that of a newspaper correspondent, should give boy readers many a thrill.

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Cut-off and filter, automatic, F J Crane ... 959,318
Cutlery cleaning machine table A Iblyarik ... 958,843
Dental engines, hydraulic motor for O L. Kellett ... 958 852
Dental forceps, E C Lombard ... 959 365
Developing tank L. N Chapin ... 958 993
Digester and the like C H Craigue ... 959,314
Dish drainer M A Dennis ... 958,857
Dish washer, A Walther ... 958,048
Dish washing machine J C Kumpp ... 959 355
Disinfecting device A P Buckland ... 959 111
Distillery slop, desiccating, Brinkmann & Wente ... 959 002
Distributing board and cross connecting rack, fused R G Hardgrave ... 958 806
Door A Ritter ... 958 076
Door catch or check, G W Mallory ... 959 241
Door check and buffer combined, L. L. Hamilton ... 958,9[illegible]
Door closer, M K Snyder ... 959 175
Door, collapsible H Hedwall ... 958 901
Door frame E A Ekedahl ... 958 793
Door operating device jail Finch & Kostits ... 959 129
Doubling and twisting machines, stop-motion for R. S. Reinhardt ... 959 263
Draft equalizing device A Hines ... 958 811
Drainage connection A A Jones ... 958,876
Dredging apparatus, W R Comfort ... 960 115
Drill A Godlewski ... 959 055
Drilling machine N D Levin ... 958 814
Drilling machine, H J Harvey ... 959 007
Dye Runkel & Herzberg ... 958,840
Dye and making black mono azo F Scholl ... 958 774
Dye and making orange disazo, M Bonliger ... 959 109
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Educational appliance J Spencer ... 958 781
Electric circuit breaker W H Scott ... 959 171
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Electric heater G E Stevens ... 959 399
Electric switch, J F McElroy ... 959 248
Electric switches, pull socket for F Barr ... 958 988
Electrical conductor hanger, W Schaake ... 958 834
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Electrically actuated switch F G Prouty ... 959 257
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Engine cylinder J G Bryen ... 958 905
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Envelop L. C Van Riper ... 958,785
Envelop O J Olm ... 958 819
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Fabrics ornaments interwoven with a brass wire, machine for applying to H Martin ... 959 242
Fan or propeller rotary H Ruthenberg ... 959 392
Fasteners machine for setting and forming metallic R B Lewis ... 959 020
Fastening members attaching means for F S Carr ... 959 108
Faucet A R Pritchard ... 958 8[illegible]
Faucet locking J S. Erickson ... 958 7[illegible]
Feed cutters knife adjusting means for J J Groumme ... 958,743
Feed water regulator L. B Fulton ... 959 341
Fence post and anchorage base P T Bailey ... 959 280
Fifth wheel for dump wagons, L. H Young ... 959 414
File and holder document J Wilson ... 959 [illegible]
File, emery cloth H. Gans ... 959 217
File paper C H. Gibbs ... 958,801
Filter for cyanid plants centrifugal C Shapley ... 959 178
Filter reducing apparatus C H Loew ... 959 021
Fire alarm systems, signal box for F S Bronson ... 958 719
Fire check A A Steward ... 958 944
Fire escape J W Thompson ... 959 404
Fire hydrant coupling E. W Purves ... 959 [illegible]
Firearm T C Johnson ... 959 016
Firearm H M Kolb ... 959 [illegible]
Firearm automatic R Frommer ... 959 002
Firearm silent H J Maxim ... 958 934, 958 935
Firearms, offset damper for telescopes for, W Renn ... 958,980
Fishing rod [illegible] W Shakespeare Jr ... 958 775
Flanges on demountable rims means for locking A Dow ... 959 426
Flies and other insects, device for catching J Nault ... 959 136
Floor dressing machine G J Kepplinger ... 958 829
Floor surfacing device C W Wiley ... 959 281
Fluid controlling device A C Nelson ... 959 025
Fluid pressure brake J W Cloud ... 959 114
Fluid pressure brake, Farmer & Turner ... 959 128
Flushing device Smith & Keneven ... 958,841
Flushing device closet C H Duncan ... 958 774
Fly wheel for warping and balling machines A E Rhoades ... 958 974
Flying machine, J Koskin ... 958 747
Flying machine J Buchanan ... 959 109
Folding box, J G Reber ... 959 201
Folding device W F Kilduck ... 959 354
Force feed lubricator H L. Davis ... 958 004
Forcing frame or inclosure for horticultural or other purposes W Cutler ... 958,966
Forging press and hammer E H Wray ... 959 094
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Front end arrangement J F & H M Brown ... 958 720
Fruit gatherer R Fountain ... 959 332
Fuel A R Hill ... 959 920
Fuel, production of T Parker ... 958,761
Furnace W H Perkins ... 958,763
Furnace, J M Brooks ... 958 993
Furnace Hough & Crowl ... 959 111
Furnace J A. Penney ... 959 253
Furnace grate, forced-draft W H Palmer ... 958 971
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Gambrel H Barrows ... 959 287
Game apparatus E P Chalmers ... 958,722
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Garment hanger combination, W C Thatcher ... 959 180
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Gas burner, B. E Meacham ... 959 244
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Gas controlling device W O Simmons ... 959 397
Gas engine, R. J Leach ... 958 881
Gas engine J V Rice Jr ... 958 975
Gas engine, reciprocating W M Leedom ... 959 019
Gas generator and burner oil G Drummond ... 958 861
Gas making apparatus P A Emanuel ... 959 334
Gas plants, pressure regulator for, F I Cross ... 958 720
Gearing, differential H A H Salomo ... 959 394
Gearing, two-speed F P Feutress ... 958 707
Glass articles, manufacture of H G Slingluff ... 958 840
Glass cutter circular W Chase Jr ... 959,311
Glass heating apparatus, A Hanson ... 959 007
Glass making apparatus wire, W S. Temple ... 959 434
Glass, method of and machine for making wire, A. J Baldwin ... 959 102
Glass tiles and similar articles, manufacture of, G W Blair ... 959 423
Glucosid and making same new, B Pouler[illegible] ... 959 027
Golf club, A C Fowler ... 959 053
Grab hook, trip M V Spencer ... 958 978
Grader and scraper road F I Reising ... 958 801
Grappling hook, hopper closet E. C Fraw ... 958,915
Grass straw and the like apparatus for separating and combing G A Lowry ... 959 240
Grease cup, J G Matheny ... 959 023
Grinding and polishing disk, C Glover ... 959,[illegible]
Gun muffler J H Ritsoco ... 959 405
Gun sight, C F Wollenberg ... 958 951
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Harness back pad and collar pad, L. P Overshiner ... 959,[illegible]
Harrow W D Walton ... 959,276
Hay rack Voll & Dringman ... 959,274
Hay rack brake I R Reeves ... 958 786
Heating device electric B L. Bailey ... 959,215
Hide unhairing machines roller for H B. Rowe ... 959,[illegible]
Hinge C Glover ... 958 740
Hinge J Tritsch ... 959 001
Hog holder, J O Beckdolt ... 959 422
Hoist R Miller ... 958,[illegible]
Hoisting and dumping mechanism J P Zoller ... 959 098
Horse controlling or hitching device, A L. Harvey ... 959 135
Horse detacher S. Molnar ... 959 373
Horse power loader, J P & J A Lucas ... 958,882
Hose coupling W W Keys ... 959,236
Hose coupling automatic train J F McElroy ... 959 152
Hose pipes, end connection for metallic E Witzenmann ... 959,187
Hub wheels, C L. Johnson ... 959 015
Hydrant attachment W H Willeman ... 959 092
Hydrated sodium carbonate and sodium tannate composition of W E Ridenour ... 958 968
Hydrocarbon burner B L. Worthen ... 958 789
Hydrocarbon burner, Walling & Olson ... 958,947
Hydrocarbon burner O Fordice ... 958 999
Ignition systems, wire bar for C Schmidt ... 958 836
Ink well H B Parsons ... 959 382
Insect trap J F Watts ... 958 786
Insulator and conductor for electric currents A Champion ... 959 052
Insulator battery plate C J Bristol ... 959 305
Internal combustion engine O A Strassburg ... 960 064
Ironing machine C B Gartrell ... 959 135
Irrigation apparatus F Olson ... 958 937
Jack J Dixon ... 959 320
Joint or miter planer tool, C R Ladeveze ... 959 017
Journal box W Neuhs ... 958 758
Keyhole guard J W Benedict ... 958 849
Kilns, fuel feeding means for cement A Neu ... 958 970
Kitchen utensil J P Ibson ... 958,875
Knitting machine yarn trap, Learman & Carter ... 959 252
Ladder J J Dennis ... 958 732
Lamp O J Holt ... 959 431
Lamp arc L. W Pullen ... 958 828
Lamp electric arc I W Pullen ... 958 897
Lamp electric arc H Beck ... 959,045
Lamp for vaporized liquid combustibles, incandescent H Kitsorin ... 959 091
Lamp metal filament C Rumnapp ... 959 075
Lamp sanctuary L. M Wilde ... 959 412
Lamp socket cluster J H Dale 958 727 to 958,729
Lantern and lunch receptacle E. Cunningham ... 959 118
Latch A Bock ... 959 295
Lawn sprinkler J B Stech ... 959 279
Lens mount H E. Richmond ... 959 100, 959 387
Level spirit C Bollmer ... 959 298
Lifting jack A Neal ... 958 969
Lifting jack C H Noyes ... 959 157
Lightning arrester W W Dean ... 959 120
Link lap I H De Rochemont ... 959 217
Liquid concentrating apparatus P Kestner (Reissue) ... 13 117
Liquid delivering device W R Haines ... 959 216
Liquid dispensing apparatus W Helmer ... 958 871
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Lock A Lawson ... 958 880
Lock C A Berry ... 959,293
Lock nut mechanism J Perrie ... 959 162
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Locomotive compressed air C G Herman ... 959 219
Locomotive front ends, draft equalizer for J Konrath ... 959,233
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Loom R H H Hunt ... 958 874
Loom R C Snow ... 959 174
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Loop setting machine W A McAllister ... 958,908
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Magneto, high frequency T M Mueller ... 958 754
Malting apparatus W H Prinz 958 821 to 958 825
Marble shooter M B Reilly ... 959 028
Massage apparatus G R Pyper ... 958,939
Match box single delivery M Myerson ... 958 966
Match safe A E Golden ... 958,802
Measuring instrument electrical, J L. Zander ... 958 792
Measuring machine cloth O Ruhlin ... 959 074
Measuring or apportioning materials of a granular or other suitable form apparatus for T H D May ... 958 965
Meats indelibly marking J Hamer ... 958 960
Melting and refining furnace electric H Nathusius ... 958,757
Metal composition Naulty & Scanlin ... 959 150
Metal shear H Taylor ... 959 083
Metals apparatus for removing tarnish from M H Keyt ... 959 227
Military field table Fleming & Curry ... 958 799
Milking apparatus G F Anderson ... 959 042
Milking machine J J Bukolt ... 958,951
Milling tooth T Lynon ... 959 328
Mirror support pivotal F O Anderson ... 959 090
Mixer See bread mixer
Mold W A Riddell ... 958 892
Mold W H Bless ... 959 438
Mold venting apparatus C B Moore ... 959 149
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Mop head C Gabel ... 959 131
Mop head and wringer combined C Gabel ... 959 130
Mop wringer S T Atkin ... 959 283
Motor starter F D Hallock ... 958,804
Motor starting cranks lock for R D Markham ... 958 815
Motors rheostatic controller for electric F D Hallock ... 958 805
Music playing instruments duplex duct tracker for automatic C S Burton ... 958 721
Music stand J D Barnes ... 959 044
Musical instrument W H Dessureau ... 959 318
Necktie braided Holahy & Dickhaus ... 958,872
Night lock C M Cock ... 959 312
Noodle cutter F I Hawkins ... 958 909
Nut self locking M Jacobs ... 959 222
Nuts making self locking S. R Hibbard ... 958 810
Oil burner T W Hunter ... 959 347
Oil burner A H Light ... 959 363, 959 364
Oil burner crude R E Bass ... 959 288
Oil can A A Weaver ... 958 949
Oils, treatment of J H Parker ... 958,890
Ores and carboniferous earths treating A A Lockwood ... 959 239
Ores, particularly oxids and sulfids reducing refractory G Boericke ... 958,851
Package cord retainer M Schmidt ... 959 396
Pad See harness back pad
Paper bag machine Vierengel & Hofge ... 958 844
Paper feeding machine Dexter & Garner ... 959 319
Paper making materials machine for kneading and grinding C Wurster ... 959,001
Paper sheets one by one from a pile apparatus for delivering P T Pollard ... 958 764
Parcel carrier J W Clark ... 958 723
Parer apple G H Hinchliffe ... 959,137
Pedal gripper attachment E F & H Pawsat ... 959 160
Pencil sharpener F Brostrom ... 958,904
Percolator C H Buck ... 959 110
Periscope W N Howell ... 959 012
Photographs means for printing S A Nielson ... 959 249
Photometer H Bryhni ... 959 051
Piano hammer H E Young ... 959 190
Piano player and talking machine combined W M Davis ... 958 731
Pianos electrical self playing attachment for I R. Smith ... 959 032
Pickling apparatus, J T An Werter ... 959 185
Pipe end closure M W Pitner ... 959 385
Pipes metallic connection for automatic connectors for train P Reahm ... 959 390
Planter, potato C Rinman ... 958 822
Planter, potato, A. McWhorter ... 959,154
Planters, fertilizer discharging attachment for corn, Rogers & Lee ... 958,772
Plow, breaking, J. H. Raggs ... 959,[illegible]

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A PERENNIAL ROTARY ENGINE.

(Concluded from page 466.)

the Parsons and Curtis types, the rotary engine serving the purpose of utilizing steam of the higher pressures under a high degree of superheat with the greatest possible mechanical efficiency and exhausting the steam at a pressure which can be readily used within the turbine, offers possibilities in economy far beyond the scope of any apparatus heretofore presented." He estimates that such a combination would show a water rate of 10.8 pounds per B. H. P.

He assumes the case of a modern battleship, with 36,000 horse-power developed on three screws, the outer screws driven by turbines of 15,000 horse-power, and 140 pounds initial pressure, the center screw being driven by a Herrick rotary engine of 280 pounds absolute pressure, and a superheat of from 100 to 200 degrees. Assuming a water rate of 12 pounds for the turbines, Mr. Lovekin arrives at his ultimate water rate of 10.8 pounds for the combination as follows:

The revolutions of the turbines will be 275 per minute.

The revolutions of the rotary engine will be 160 per minute

The effective stroke of the rotary engine will be 17 feet.

The clearance will be 12 per cent.

The stroke, plus the clearance, will be equal to 19 feet.

The distance swept by the piston per hour, allowing for clearance, will be

$19 \times 160 \times 60 = 182,400$ feet.

The total cubic feet of steam used will be $390,000 \times 3.2 = 1,248,000$

The area of the piston will be

$$\frac{1,248,000}{182,400} = 6.85 \text{ square feet.}$$

Assume pistons 16 inches high,

$$\frac{6.85 \times 144}{16 \times 3} = 20\tfrac{1}{2} \text{ inches,}$$

width of each piston. (3 in all.)

The horse-power developed by the rotary engine is as follows

2 expansions = 0.8465

280 × 0.8465 = 237 pounds.
140 pounds back pressure.
97 pounds.
0.80 ratio of actual mean to theoretical pressure.
77.60 (Approximate.)

$$\frac{78 \times 17 \times 6.85 \times 144 \times 160}{33,000} = 6,280 \text{ H. P.}$$

for rotary engine.

Assuming 6,000 B. H. P., with a propeller efficiency of 60 per cent.

The turbines will give out 30,000 B. H. P at 50 per cent

The rotary will give out 6,000 B. H. P at 60 per cent.

Total . . . . 36,000 B. H. P.

$$\frac{390,000}{36,000} = 10.8 \text{ pounds of water per B. H. P.}$$

RADIUM BATHS.

(Continued from page 461.)

ried into practice on a large scale by the Administration of the Municipal Salines of Kreuznach, Germany, where drinking and bathing water, artificially treated by the very radioactive substances contained in the springs, is manufactured and sold.

Though details of the process used in this connection are as yet kept secret, we are enabled by the courtesy of the administration mentioned, to place before our readers a general account of the methods by which brine is prepared and treated for radioactive substances, which in their turn are used to energize ordinary cistern water or to increase the efficiency of any therapeutic product.

The Kreuznach brine, which contains besides other elements iodine and bromine, yields, after boiling [illegible]

([illegible] from page 461.)

[illegible] and [illegible] device, [illegible] ... [illegible]
[illegible] C. Lindstrom [illegible]
[illegible] apparatus [illegible], G. von Arco ... 959,180
[illegible] call mechanism, party line, W [illegible] ... [illegible]
[illegible] H. F. Voss ... [illegible]
[illegible] W. Kaisling ... [illegible]
[illegible] D. T. Mason ... [illegible]
[illegible] switch hook, E. V. Sweet ... [illegible]
[illegible] system, W. W. Dean ... [illegible]
[illegible] system, Gradolph & Hakes ... [illegible]
[illegible] system party line, R. J. Roberts ... [illegible]
[illegible] systems, party line call register [illegible] automatic, A. H. Dyson ... [illegible]
[illegible] A. Swaney ... [illegible]
[illegible] tube, O. Mackensen ... [illegible]
[illegible] conditioning apparatus, J. E. Palmer ... [illegible]
[illegible] tool, steam, G. H. Finnegan ... [illegible]
[illegible] guide, J. E. Palmer ... [illegible]
[illegible] machine band cutter and feeder, [illegible] & Graham ... [illegible]
[illegible] machine, seed, D. Hummel ... [illegible]
[illegible] bundle or package tie, [illegible] W. H. Starr ... [illegible]
[illegible] J. Flindall ... [illegible]
[illegible] and distributor, C. Cuno ... [illegible]
[illegible] Kessler, Jr. ... [illegible]
[illegible] O. A. Russell ... [illegible]
[illegible] vehicle, J. Allsted ... 959,041
[illegible] for valve stems for pneumatic, G. [illegible] ... [illegible]
[illegible] armor for pneumatic, J. L. Le Briere ... [illegible]
[illegible] machine, J. O. Morris ... [illegible]
[illegible] clothes, W. J. & A. Ott ... [illegible]
[illegible] adjustable pattern for N. [illegible] Smith ... [illegible]
[illegible] N. M. Hansen ... [illegible]
[illegible] holder, J. J. McIntyre ... [illegible]
[illegible] holder, J. J. Moeller ... [illegible]
[illegible] holder, ratchet, J. Volbert ... [illegible]
[illegible] crown, P. Schaefer ... [illegible]
[illegible] replaceable, F. La Chapelle ... [illegible]
[illegible] R. Bourdelles ... [illegible]
[illegible] W. E. Headron ... [illegible]
[illegible] base ball game apparatus, J. A. [illegible] ... [illegible]
[illegible] engine, L. M. Merkley ... [illegible]
[illegible] builder's, O. Kunerert ... [illegible]
[illegible] mechanism, E. R. Williams ... [illegible]
[illegible] self cleaning, O. L. Byus ... [illegible]
[illegible] and box, aerial mail, T. G. & C. [illegible] G. Anderson ... [illegible]
Trolley conductor clamp, W. Schaake ... [illegible]
[illegible] poles and other articles, clamp for mending broken, R. W. Lovett ... [illegible]
Trolley wheel holder and guide, Gunn & Lisk ... [illegible]
Trolley wire car, J. H. Callender ... [illegible]
Trolley wire hanger, J. T. Scanlon ... [illegible]
[illegible] S. J. Summers ... [illegible]
[illegible] slide bearing for, S. J. Summers ... [illegible]
[illegible] band regulator and belt retainer, combination, J. E. Weil ... [illegible]
[illegible] hanger, W. C. Thatcher ... [illegible]
[illegible] rack, T. A. Cleary ... [illegible]
Truck brake baggage, Parker & Lieb ... [illegible]
Truck for planters, etc., front, J. D. Brim ... [illegible]
Truck maximum traction, W. S. Adams ... [illegible]
Tube. See telescopic tube.
Tug, buggy shaft, W. G. Petree ... [illegible]
[illegible] machine, G. R. Bennett ... [illegible]
Type casting and setting machine individual, J. C. Fowler ... [illegible]
Type machines, mold and operating mechanism for, R. S. Dunavant ... [illegible]
Typewriter attachment, T. M. Morgan ... 959 084
Typewriters, column stop mechanism for, Knapp & Harting ... 959 061
Typewriting machine, A. W. Smith ... [illegible]
Typewriting machine, J. O. McLaughlin, [illegible],917, [illegible]
Typewriting machine, J. A. Edlund ... 959 125
Umbrella, W. Edwards ... 959,137
Umbrella folding, O. K. Andrews ... 958,714
Umbrella folding, P. Penman ... [illegible]
Umbrella holder, S. A. Reithmiller ... [illegible]
Underclothing, C. M. Begley ... [illegible]
Universal joint, A. H. Fetzer ... [illegible]
Upsetting machine, D. E. Ward ... [illegible]
Valve, G. M. Bard ... 958,716
Valve, E. D. Jefferson ... [illegible]
Valve, automatic hose, L. E. & W. Smith ... [illegible]
Valve for air brake systems, regulating, J. O. Lama ... 959 022
Valve for heat engines, puppet, L. G. Nilson ... [illegible]
Valve mechanism for engines, J. W. Guthrie ... [illegible]
Valve, relay air, H. J. Richardson ... [illegible]
Valve, steam, air, and water trap, J. E. Boegen ... [illegible]
Valve timer, gas engine, T. P. Huden ... [illegible]
Vapor burner, A. H. Waite ... [illegible]
Vault closure, F. Unckrich ... [illegible]
Vegetable washer, H. J. Judge ... [illegible]
Vehicle body structure, E. H. Remde ... [illegible]
Vehicle body structures, fastening device for, R. Greenfeldt ... [illegible]
Vehicle brake, automatic, G. W. Whitcomb ... [illegible]
Vehicle child's, C. E. Foorman ... [illegible]
Vehicle controlling mechanism, motor, L. Whitcomb ... [illegible]
Vehicle propelling mechanism, motor, Lacoste & Battmann ... [illegible]
Vehicle rim, A. A. Ley ... [illegible]
Vehicle shock absorber, Riley & Hunt ... [illegible]
Vehicle, single track, R. Scherl ... [illegible]
Vehicle spring, C. B. Geiger ... [illegible]
Vending machine, C. Manshel ... [illegible]
Vessel, submarine, A. J. Griffin ... [illegible]
Violin bow, F. Della Torre ... [illegible]
Vise, door fitting, O. E. Rowe ... [illegible]
Volume regulator and indicator, F. L. Cross ... [illegible]
Wagon jack, S. L. Pore ... [illegible]
Wagon seat fastener, L. M. Lattimore ... [illegible]
Washer. See dish washer.
Washer and gasket cutter, J. A. Rowe ... 958,941
Washing machines and other containers, hoop handle for, J. R. Rhinehouser ... 958,745
Watch and clock cushion friction, F. Wehinger ... [illegible]
Watch, repeating, H. M. & O. Reimer ... [illegible]
Water heater and purifier, H. White ... [illegible]
Water heater, electrical, H. D. Wood, Jr. ... [illegible]
Water purifier, centrifugal, W. K. Richardson ... [illegible]
Water purifying and sterilizing, A. Bundey ... [illegible]
Water, purifying or clarifying, W. K. Richardson ... 958,769
Water softening apparatus, H. Hassell, [illegible], [illegible]
Water wheel gates, apparatus for operating, W. W. White ... [illegible]
Waterproof fabric, G. Street ... [illegible]
Wave power, S. R. Goff ... [illegible]
Weaving pile fabrics, J. Buckley ... [illegible]
Welding machine, electric, A. E. Buchenberg ... [illegible]
Well tubing, etc., joint for, C. M. Hester ... [illegible]
Well tubes, unscrewing mechanism for, H. C. Johnston ... [illegible]
[illegible] machine, W. H. Keighley ... [illegible]
[illegible]

[illegible] copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

[illegible]

(Continued from page 468.)

the mother liquor this process is very complicated and expensive

The brine is vaporized in graduating works, the output of which depends on the season, the direction and intensity of winds, as well as on the temperature and moisture of the air. Each of these graduating works (the total length of each is approximately 2.5 kilometers) is divided into seven compartments of decreasing lengths traversed consecutively by the brine, and the salt content increasing as each compartment is traversed. After leaving the last compartment the weak solution is from eight to twelve times more concentrated. The bramble walls of the compartments are exposed to the wind. Hence operation of the plant is difficult in variable winds. On the other hand, the surrounding air which is strongly ozonized and charged with atomized brine, not only makes the graduating works a very cool and pleasant place to stay in on hot days, but affords a welcome opportunity for utilizing the curative effects of the refreshing salt air.

The pumps of the graduating works are operated by a number of water wheels fed from the river Nahe through a system of canals. From the graduating works the brine is pumped through conduits to the reservoirs of the evaporating house, in order there to be boiled.

Both the evaporating house and graduating works date from the middle of the eighteenth century when the Salines were erected, the ancestors of most of the workmen employed therein having spent their lives in the works.

The primitive boiling process carried out in open salt pans has recently given way to a modern multiple vaporizer with improved devices for recovering the mother liquor and the salt. It consists of a steam boiler and a number of vaporizers, an air pump, etc.

As the boiling of the brine and mother liquor is carried out *in vacuo* at low temperature the decomposition of valuable chemical compounds is entirely prevented, thus increasing the curative effects of the products.

When the brine has been boiled down to such concentration as to contain in a hundred kilogrammes twenty-two kilogrammes of common salt, a supersaturated solution is obtained from which the salt crystallizes. As the concentration of the brine increases then increasing amounts of salts are separated which impart to the salts an acid taste. These salts are used for various therapeutic purposes while the brine left after the separation of the common salt forms the mother liquor used for other therapeutic purposes and of which about 350,000 liters are produced per annum. For shipping great distances, the mother liquor is further concentrated until it crystallizes in lumps.

Experiments commenced in 1904 have shown that the Kreuznach water contains not only plentiful amounts of gaseous radioactive emanation but carries along from the interior of the earth radioactive substances. Part of these substances as the water during the graduating process comes into contact with the air will separate along with iron oxide, calcium and barium carbonate while another part remaining in solution forms in the brine a permanent source of emanation. Experiments made by Elster and Geitel, as well as by Dr. K. Aschoff, have shown that the residues contain not only considerable traces of radium, but radiothorium and actinium as well. The mother liquor derived from the Kreuznach brine as well as from the bathing salt was likewise found to be strongly radioactive. Further experiments demonstrated the possibility of isolating traces of radium from the residues of concentrating the radium salts. As the springs of Kreuznach yield every year radioactive residues by the hundredweight it was deemed advisable to attempt the production of radium salts on a large scale. Mr.

(Concluded on page 470.)

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Inquiry No. 9019. Wanted machinery necessary for an installation of a plant for refining salt by a [illegible] diffraction of the Bessemer process.

AUTOMATIC LEMONADE MACHINES for sale and patents. Good chance. Address A. E. Griffith, 333 West 17th Street, New York City.

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FOR [illegible] I WILL SELL MY SECRET of solution that will hold the moist in dry battery cell. My secret and Hot Springs, Ark., waters will make the best dry battery in the world. For farther particulars, address Oscar Nelson, 10 St. Marks Avenue, Brooklyn, N. Y.

Inquiry No. 9029. Wanted catalogues and all information on machinery for braiding straw in manufacturing straw hats.

WANTED

WANTED addresses of dealers, manufacturers, or inventors of proved dry placer mining machine for extracting even small percentages of gold from dust or dry sand. Address L. C. Scharer, Ft. Bayard, New Mexico.

Inquiry No. 9038.—Wanted the address of the Chipman Electric Purifying Co.

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Inquiry No. 9076.—Wanted the address of parties in Canada who could make a safety razor.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9077. Wanted the address of manufacturers that make small articles of wood such as checker boards, etc.

MISCELLANEOUS.

WE are about to complete a large contract for Taxi meters and are therefore in a position to take up experimental work, manufacture of fine instruments, parts for the same, dies, jigs, etc. Precision Tool & Instrument Co., 8-18 Canal Place, New York City.

Inquiry No. 9078. Wanted the address of manufacturers of sewer pipe made of fiber and asphaltum suitable for laboratory use.

Inquiry No. 9080.—Wanted the address of parties manufacturing paste making machinery.

Inquiry No. 9083. Wanted the address of firms manufacturing small beer brewing plants from 15 to 100 gallons a day.

Inquiry No. 9093. Wanted the address of some firms who manufacture permanent lamp wicks.

Inquiry No. 9094.—Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9096.—Wanted the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted address of makers of impulse water wheels.

Inquiry No. 9098.—Wanted name and address of the manufacturers of the ozonizer.

Inquiry No. 9099.—Wanted address of manufacturers of machinery for making wire cables.

Inquiry No. 9101. Wanted addresses of manufacturers of a dip or magnetic needle, for exploring for iron ore.

Inquiry No. 9107.—Wanted addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109. Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9113. Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114.—Wanted name and address of manufacturer of the Auto Lantern Globe. Fits all lanterns.

Inquiry No. 9115.—Wanted a machine for making [illegible] similar to Wm. Michael's G. & J. [illegible] and Waverly [illegible].

Inquiry No. 9117.—Wanted names and addresses of the manufacturers of [illegible].

Inquiry No. 9118. Wanted a muffler for a gasoline engine built upon the principle of the Maxim silencer recently brought out for use on rifles.

Inquiry No. 9119. Wanted name and address of the manufacturer of Martin bullet proof cloth.

Inquiry No. 9120.—Wanted the address of the Idea Fuel Feeder Co.

Inquiry No. 9121.—Wanted manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9124. Wanted name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9127.—Wanted, address of L. Dermigny, manufacturer of a family ice machine for $12.50.

Inquiry No. 9128. Wanted, manufacturers of a gasoline traction engine with a hoisting attachment; in other words, the machine will be used as a portable stump puller to pull sassafras roots used in making oil of sassafras.

Inquiry No. 9134.—Wanted a small hydraulic motor capable of giving about one horse power with a water power of 35 lbs. per square inch.

Inquiry No. 9135.—Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted the address of manufacturers of machines capable of forming a number (15 or more) of pieces of paste about 30 mm. x 15 mm. x 6 mm., made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 4 mm. The process could be somewhat similar to biscuit making.

Inquiry No. 9139.—Wanted the name and address of some manufacturer of a coffee mill run by water motor.

Inquiry No. 9140.—Wanted manufacturers of disc records for gramaphones that use a sapphire point instead of a steel needle.

Inquiry No. 9142.—Wanted name and address of the manufacturers of an air mat rest.

Inquiry No. 9144.—Wanted manufacturers of machinery for making soda water tubes commonly known as straws.

Inquiry No. 9145. Wanted to buy machinery to load blasting caps or detonators.

Inquiry No. 9149. Wanted manufacturers of machinery for roasting coffee for small and large industries.

Inquiry No. 9150.—Wanted, manufacturers of machinery for the manufacture of French heels for ladies' shoes.

Inquiry No. 9151.—Wanted the address of the Graham Safety Lamp Filler and Ventilator.

Inquiry No. 9152.—Wanted name and address of manufacturers of a knotless clothes line.

Inquiry No. 9154. Wanted name and manufacturers of a newspaper vending machine.

Inquiry No. 9155. Wanted the address of manufacturers of an electric milking machine.

Inquiry No. 9156.—Wanted the name and address of manufacturers of a rust proof oil known as Caseboes Oil.

Inquiry No. 9157.—Wanted manufacturers of peanut shelling and cleaning machinery.

Inquiry No. 9159.—Wanted manufacturers of a material in sheets to take the place of vulcanized fibre for novelty work.

Inquiry No. 9160.—Wanted manufacturers of any successful substitute for hard rubber.

Inquiry No. 9161.—Wanted, a machine that will grind oranges, pulp and skin into a smooth liquid or cream.

Inquiry No. 9163.—Wanted, addresses of shirt makers in Manhattan who will make a few shirts of special design.

Inquiry No. 9168.—Wanted, manufacturers of a cradle worked by clock work.

Neumann, Director of the Kreuznach Salines undertook experiments according to a method worked out by Dr Aschoff. One of the wings of the boiling house was converted into a radium factory, which has been operated for over a year. The entire annual production of active residues is now worked into radium salts, an end which has made possible an extensive therapeutical use of radium compounds, both as a white insoluble powder of high radioactivity for compresses, ointments, etc., or directly in a dried condition, and—on a far larger scale—in the shape of gaseous emanation transmitted to water.

An apparatus perfected by Mr Neumann renders it possible to determine the amount of emanation imparted to a given quantity of water.

Mr Neumann has recently worked out an improved charging method which is especially suited for imparting to any liquids a very intense activity (2 000 to 50 000 Mache units). However, no details as to this method have as yet been made known.

Satisfactory results have been obtained by treating, by means of charged drinking or bathing water, chronic rheumatism of the joints, and gout, while a number of other complaints are favorably acted upon.

An interesting fact ascertained by those physicians who have tried the radium-water treatment, is that many patients at the beginning of the cure will show a striking reaction, consisting of a recrudescence of some symptoms of the malady, and in some cases in some trouble in the general condition (insomnia, loss of appetite, etc.). In some cases this reaction manifests itself as a slight feeling of intoxication during the bath and some minutes afterward, while other patients feel especially refreshed and invigorated. This reaction, which strikingly resembles the reaction produced by many natural bathing and drinking waters, is a presage of success.

Though this radium-water cure, is yet of too recent date to allow definite conclusions to be drawn, it doubtless constitutes a valuable addition to the present methods of modern medicine.

ALEXANDER GRAHAM BELL.

(Continued from page 462.)

the free end of one of his steel reeds to the center of a membrane capable, like the ear drum, of taking up any kind of vibration. The fixed end of the reed was not to be clamped, but was to be hinged loosely to the polarizing magnet, so that it would no longer have any definite rate of vibration, but would follow all the vibrations of the membrane. A similar instrument was to be used as a receiver. But the apparatus was not constructed at that time because Bell doubted whether the currents generated by the action of the voice alone would suffice for practical telephony. Furthermore, he was induced by his associates to devote his attention to multiple telegraphy.

One day in tuning and testing the clamped reeds of his transmitters and receivers he found that the receiving reed vibrated and sounded when the transmitting reed of the same pitch was plucked, although the battery was not in circuit. This discovery convinced him that the membrane speaking telephone devised a year earlier could be made to work.

The long and patient researches that followed cannot be here detailed. Membranes with attached patches of iron and steel of various dimensions were tried and the apparatus was varied in many other ways. Then it was discovered that a thin sheet of iron could be used as the membrane. Thus were developed, successively, the apparatus patented in 1876, the telephones that created so profound a sensation at the Centennial Exhibition in the same year, the instruments patented in 1877, and the familiar hand telephone which, with some modifications, is still universally employed as a telephone receiver.

From the beginning Bell had aimed at the production of an undulatory current capable of representing all the component harmonic vibrations of vocal sounds. This fact sharply distinguishes his invention from the old Reis telephone which, employing an intermittent current produced by alternately making and breaking the circuit, reproduced only the pitch of a sound, but not its quality or *timbre*, and was consequently unable to transmit vocal sounds and articulate speech.

It is safe to say that no patents for any invention have been subjected to such long and bitter litigation as the Bell telephone patents. During one of the many suits which involved the validity of the patent Mr Bell was on the stand for fifty-two days, during which time he recited the history of his invention with a clearness and conciseness that still characterize both his writings and his speeches. As we see it to-day, the telephone is practically the same in principle and construction as when it left its inventor's hands, so far as the receiver is concerned. Few inventions have changed so little. To be sure, the appearance of the apparatus has been greatly modified. The multiple switchboard and the common battery system have been introduced, and the very difficult art of telephone engineering has been developed. But for all that, the telephone still remains the same in principle.

Professor Bell makes no claim to business ability. He even states that had it not been for his father-in-law, Mr. Hub-

(Concluded on page 471.)

(Concluded from page 478.)

... first president of the first telephone company, it is doubtful if the telephone industry would have been so rapidly developed. Fortunately, the original owners and promoters of the telephone were, above all, business men, actuated by the sole idea of developing the business along broad lines. Whatever reward they expected or received was the legitimate reward following the legitimate development of a substantial and beneficial business. To develop that business it was first necessary to develop an art. There was nothing like that art in existence at the time. Indeed, the whole art of the practical application of electricity was new

The telephone is not the only art with which Professor Bell's name is linked In wireless signaling, too, he made some early experiments which, had they been extended, might eventually have led him into the field of wireless telegraphy and telephony During experiments which he made on the Potomac River in 1878 and 1879, he succeeded in signaling for over a mile He informed the writer of this article that an account of his work on the Potomac River which he gave to Preece in England, may possibly have influenced Preece in his own work His attention was first called to the subject in 1877, when he was experimenting on ground connections He used pokers as terminals. When he thrust a poker into the ground and put the telephone to his ear he heard a clock ticking It was the Cambridge Observatory clock, which he easily recognized because it missed a tick now and then as it regulated the time in Boston Cambridge was nowhere near Mr Hubbard's country seat, where the experiments were conducted

Aerial locomotion is another art with which Professor Bell has become identified His interest in the subject was aroused when, in 1880, he began to make kite-flying experiments, largely for the sake of his health He started with a Hargrave box kite and eventually developed the tetrahedral principle, which is now well known among aeronauts. During the course of his experiments he found that he needed the services of civil and mechanical engineers Accordingly, a little association was started under the name "Aerial Experiment Association," which included among its members the late Lieut. Selfridge, Glenn Curtiss, Baldwin, and McCurdy, all of them now well known. Baldwin and McCurdy acted as engineers, Curtiss was the motor authority. The association was Mrs Bell's idea, and was founded to carry on Mr Bell's own work. She sold the only piece of property which was hers in her own right, and which had not been given to her by Mr Bell, in order to finance the association. Although these engineers were all originally engaged to help Mr Bell in his tetrahedral experiments, the members of the association ended by helping one another Selfridge was the first man who profited by the association's assistance. Believing that it was best to follow in the footsteps of others, and then to improve on their work, he started with gliders, and finally built the "Red Wing," which flew successfully Next came Baldwin's chance He embodied his ideas in the "White Wing," in which wing tips were introduced, controlling devices which are now the subject of so much controversy Then came Curtiss's "June Bug," which won the Scientific American Trophy McCurdy followed with the "Silver Dart." Baldwin and Bell worked at the tetrahedral principle in Nova Scotia, experiments which are not yet concluded. Curtiss remained at Hammondsport, New York, and Selfridge was recalled to Washington by the War Department. The association was so scattered that it was necessary to adopt some means of communication. Hence, the weekly bulletins were started under the title "Bulletin of the Aerial Experiment Association," which had a combined circulation of seven, and which served the purpose of keeping the members in touch with one another

HEIGHT OF THE ANTARCTIC CONTINENT.

(*Concluded from page 464.*)

concludes that, if the continent covers an area of 5,200,000 square miles as Bruce and Kreummel assume, its mean elevation above sea level is about 6 600 feet with a probable error of ± 660 feet.

If this estimate is approximately correct, as the results of the recent explorations appear to indicate, the Antarctic continent is by far the highest mass of land on the globe By the addition of this huge polar cap the mean elevation of the entire land surface of the earth is increased from 2,312 feet to 2,706 feet.

The process by which Meinardus reached these conclusions may be sketched as follows It was already known that the mean height of the barometer over the northern hemisphere is 0 8 millimeter higher in January than in July, but that the corresponding barometric height for the zone extending from the equator to 50 degrees south latitude is 2 1 millimeters lower in January than in July Hence, as the entire mass of the atmosphere and consequently the average atmospheric pressure over the whole surface of the globe remains constant, the mean barometric height for the zone south of 50 degrees south latitude, which is equal in area to about one-fourth of the southern hemisphere, must be about 3 6 millimeters greater in January than in July

The observations made by recent explorers, however, led Meinardus to the conclusion that the mean atmospheric pressure over the zone lying between 50 degrees south latitude and the Antarctic circle is not greater, but is 0 73 millimeter less in January than in July This result increases the January deficit of pressure and restricts the area in which it can be made up to the Antarctic zone, in which, consequently the mean atmospheric pressure must be 11 millimeters higher in January than in July Within the Antarctic circle the only observations available for this discussion are those of the ships Discovery Belgica and Southern Cross,' which together comprise the records of four entire years In three of these years the atmospheric pressure was lower in January than in July Thus the area in which compensation for the deficit can be sought is still further restricted, apparently to the Antarctic continent

Meinardus finds the explanation of this puzzling state of affairs in the great height of the Antarctic continent The atmospheric pressure diminishes as the elevation of the point of observation increases, and the difference is greater at low than at high temperatures Hence, in a region where the atmospheric pressure is constant throughout the year at the sea level, it is appreciably higher in summer than in winter at an elevation of several thousand feet. For a given elevation this difference increases with the difference between the summer and the winter temperature Meinardus and Hann have computed that the mean atmospheric temperature of the Antarctic continent is +26 6 deg F in January (Antarctic midsummer) and −14 8 deg F in July (Antarctic midwinter) In these conditions it can be calculated that the mean excess of January over July pressure (11 millimeters) required for the entire Antarctic zone would be furnished by a mean elevation of that zone of about 4 400 feet on the assumption of a constant atmospheric pressure at the sea level But the coasts of the Antarctic continent have been explored sufficiently to make it reasonably certain that that continent occupies very approximately, two-thirds of the entire area of the Antarctic zone Hence, on the assumption of a constant atmospheric pressure over the remaining third which is covered by water, Meinardus arrives at the conclusion that the average height of the Antarctic continent is about 6,600 feet

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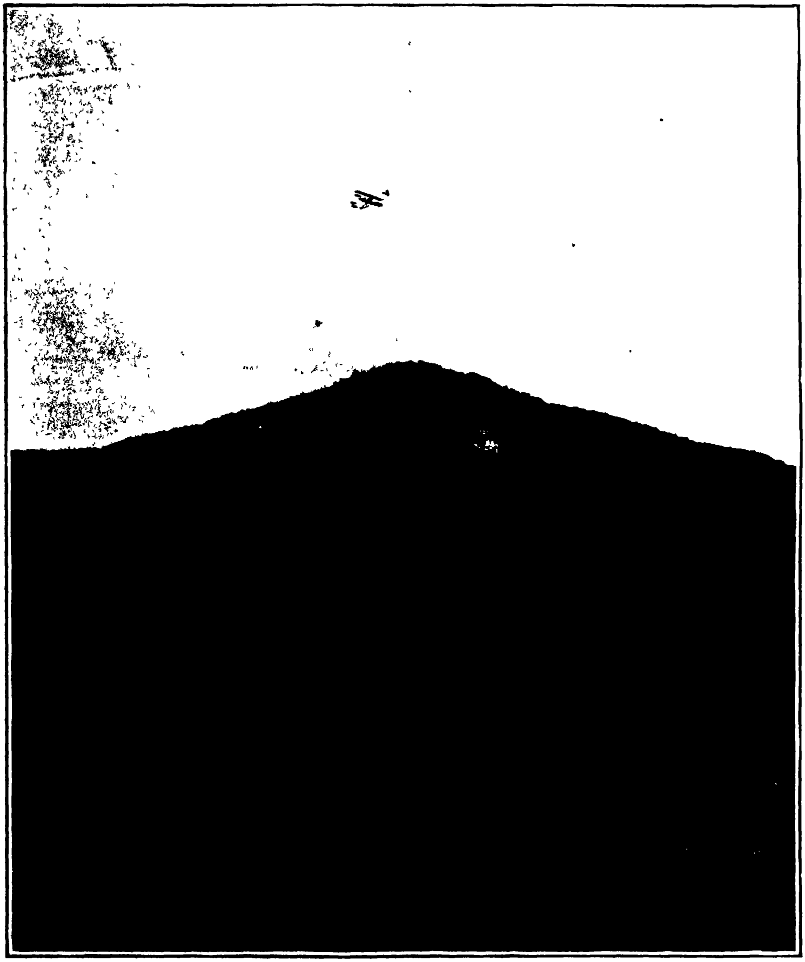

THE HISTORIC FLIGHT OF GLENN H. CURTISS DOWN THE HUDSON RIVER.—[See page 480.]

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NEW YORK, SATURDAY, JUNE 11th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE NEW ERA OF AERONAUTICS IN AMERICA

It is a curious anomaly that, although America is the birthplace of the practical flying machine—a distinction which is universally admitted and stands in little danger of future disputation—the further development of the art of flying, as first demonstrated by the Wright brothers, has hitherto been confined mainly to European countries. To us, it has always seemed probable that our apathy was more apparent than real, and that when sufficient stimulus was offered, the art of aviation was sure to come into its own, and its development be prosecuted with a zeal that was worthy of the energy and liberality of the country in which the first practical flying machine had its birth.

Evidently the needed spur has been afforded by the phenomenal achievement of Glenn H. Curtiss in making his recent flight from Albany to New York at the unprecedented speed of over fifty miles an hour—a feat which vindicated both the far-sightedness and the liberality of the New York World in offering a prize of $10,000 for such a flight in connection with the recent Hudson-Fulton festival.

Apart from the fact that so great a distance was covered at so high a speed, there are other considerations which largely account for the powerful hold which this flight has taken upon the public imagination, such for instance, as the altogether untried nature of the course, the almost complete absence of suitable landing places, and the absolute composure with which, when an emergency landing had to be made, the aviator circled in his path, swooped down, bird-like, upon a small open clearing above the rocky and hill-covered cliffs, landed, started again on the final leg of his course above the crowded shipping of the North River, and finally came to rest on Governor's Island at the very doors of the house which was built for him during the Hudson-Fulton aeronautical contests. Here was a man who at the very first trial and over a course which, because of the encompassing mountains and ravines and the resulting air currents, was believed to be exceptionally difficult, accomplished with evident composure and at times with a suggestion of complete *sang froid* a feat of flying which only six months before, was regarded as a dream of the enthusiast.

When the news of his accomplishment was flashed throughout the country, its effect was instantaneous and positively electric. The last doubt as to the practicability of long-distance cross-country flying vanished, and the evidence of the awakening was shown in the almost immediate offer of over $100,000 in prizes for flights of a similar character, to be held during the present season in various parts of the United States. First came the simultaneous and munificent offers of $25,000 by the New York Times and the Chicago Evening Post for a Chicago-New York flight of about 980 miles, and of the New York World and the St. Louis Post-Dispatch of $30,000 for a St. Louis-New York race over a 1,000-mile course. Then the Washington D. C. Chamber of Commerce and the Aero Club of Washington offered $20,000 for a 225-mile race from Washington to New York; and as we go to press a $10,000 prize is being promoted in St. Louis for a flight from that city, over a distance of about 250 miles to Kansas City, and $5,000 is offered for a flight over a 250-mile course from Indianapolis to Chicago.

Such are the attractive prizes that have been made available, within a week of Curtiss's flight, to promote long-distance feats of the same character. At the same time, through the liberality of Mr. Edwin Gould, as noted elsewhere in this journal, attention is being directed to the mechanical improvement of the aeroplane itself, with a view to enlarging its ability to remain continuously in the air and extend the duration of its single flights. The offer of the large sum of $15,000 for the best successful aeroplane provided with two motors, one to be held in reserve for emergency, is certain to prove a great stimulus to inventors and constructors, and should result in the production of some very interesting combinations of motive power.

The above *résumé* of the happenings of the past week surely justifies the statement that, when the history of the art of flying in America comes to be written, this period will stand out as second only in importance to those ever-memorable days, when the Wright brothers were making their flights above the sand hills of North Carolina in the first practical man-carrying and controllable aeroplane propelled by its own motor.

THE PERIL OF THE SUBMARINE.

Judged by the number of tragic disasters which has overtaken the submarine during the past few years, this greatly dreaded instrument of war might seem to be as great a menace to friend as to foe. In the absence of accurate information as to how many lives were accounted for by the submarine during the Russo-Japanese war, it is a question whether in the last ten years the submarine has not caused the death of a greater number of its own crews than it has of the enemy, and we hazard the statement that considerably over half a hundred lives have been sacrificed during the past ten years in the ordinary peace maneuvers of submarine vessels. The long roll of disaster is headed, in point of loss of life by the sinking of the French vessel "Pluviose" on May 26th last, off Calais, when 28 officers and men lost their lives. The most fatal, as it is the most frequent, cause of accident is collision. We all remember the running down of a British submarine off Spithead by an outward-bound Orient liner which came up from behind unnoticed, and apparently passed entirely over the submarine. Within the year a similar accident happened at the entrance to the English Channel, when a large ship ran through a fleet of submarines at night time, sinking one of the boats. To the same cause was due this recent French disaster, the "Pluviose" being struck by the paddle-wheel of a Calais-Dover passenger steamer as the latter was leaving Calais harbor.

At the same time, although we deplore the terrible loss of life which has occurred, we must not permit these disasters to shake our faith in the utility of the submarine; for the accidents have been chargeable to inefficient handling, or shall we say to lack of sufficiently wide experience, rather than to any inherent mechanical defects in the design or construction of the submarine itself. In recent years, outside of those due to collision, the losses have been chargeable, not to theoretical or mechanical defects in the boats themselves, but to carelessness or inexperience in their manipulation. Testimony to this effect was afforded by the diary (an amazing document) which the commander of the Japanese submarine, that was recently sunk, continued to write up to the very hour of his death, in which with characteristic Japanese nobility he took the blame for the loss of the vessel directly upon himself. Mechanically speaking, the highly-developed submarines of to-day, as exemplified in the latest types built for our own navy, are thoroughly reliable. The writer speaks from experience, having spent some four hours and traveled some twenty miles under the sea last summer off the point of Cape Cod, in the recently completed "Stingray." The vessel descended, ran on an even keel, rose to the surface and was steered, with absolute precision; the air within the submarine was perfectly wholesome and free from odor, and the composure of the officers and crew betokened a perfect confidence in the stability of the vessel.

The disaster to the "Pluviose" proclaims the necessity for that eternal vigilance which is the pledge of safety in travel not merely beneath the sea, but in the air and on the dry land. The charge can be no longer made against the submarine that it is "blind." In the perfected periscope, the vessel is provided with an eye whose vision is as clear as that of the binoculars of a commanding officer on the bridge of a warship. Furthermore there has been produced and is now obtainable a periscope which commands a view of the complete horizon during such time as the submarine is within, say, ten or fifteen feet of the surface, and with such an instrument, given clear weather and a careful lookout, the danger of being run over by a ship coming up from behind should be completely eliminated. The accident to the "Pluviose" seems, however, to have been due to the submarine rising to the surface just ahead of, and in the path of, the Calais steamer. Here is a very real and not easily prevented danger. Although the commanding officer may take a careful survey of adjacent waters and note the position of other craft before he dives, such is the speed of modern vessels that a ship may easily have passed into close proximity by the time the submarine rises again to the surface, even though the period of submersion be limited. Collision on rising to the surface is a form of accident which for the present, at least, must be regarded as not entirely preventable.

"MECHANIPULATE."

If the proper role for language to play in the round of our daily life is that not of master, but of servant of our necessities, we should surely be at liberty to add new words to our vocabularies whenever necessity calls for them. Let it be remembered, however, that the addition of the new word and the modification or elimination of the old should be done always in a spirit of profound conservatism, and only under the spur of a well-recognized necessity.

It is agreeably to this spirit that we indorse the use of the word "mechanipulate" to designate the handling of a piece of work by a machine. At the present time, all the many elaborate and ingenious operations which are performed by mechanical hands and fingers frequently with a close approximation to the delicacy and dexterity of the movements of the human hand, have to be designated by the word "manipulate"—which is distinctly a misnomer. If the work in question could be manipulated with the same facility, dispatch, and economy with which it is *mechanipulated*, the mechanical operations would never have been introduced. The credit for the suggestion of this serviceable word is due to Mr. Henry A. W. Wood, and as far as we know, its first use is to be found in his article on "Modern Stereotypy," in the issue of the SCIENTIFIC AMERICAN SUPPLEMENT of May 14th, in which, speaking of a plate that has been cast he says: "It is left face up . . . in position to be most easily mechanipulated, . . . the mechanism used for the purpose acting with a gentle, uniform motion to position the matrix with accuracy," etc. Then, in a foot note the writer says: "In my experience, I have frequently felt the need of a word which should express the 'handling' of its work by a machine, as the word 'manipulate' expresses the handling of the work of a man by his hands. To fill the gap I have made bold to coin and use the word 'mechanipulate,' which is here employed." In bringing the suggested word to the attention of the public, we invite a discussion of its merits in the correspondence columns of the SCIENTIFIC AMERICAN.

THE COLDEST REGION OF THE ATMOSPHERE.

The decrease in the temperature of the air with increasing altitude—exemplified in the fact that the top of a mountain is colder than its base—is a matter of common knowledge. It is a fact that occasional inversions of this distribution of temperature may occur—as when fruit trees in a valley bottom are nipped by a frost that does not touch the hilltops; but it remains true in general, that the temperature of the air decreases upward and that the air at great altitudes is extremely cold as compared with that at the surface of the earth.

Until Teisserenc de Bort announced his discovery of the isothermal layer, eight years ago, it was not suspected that this decrease of temperature did not extend upward to the limits of the atmosphere. Now, however, we know that at a certain altitude, averaging in middle latitudes, about 11,000 meters (7 miles), the fall in temperature with increasing altitude ceases rather abruptly, usually giving place to a *rise* of temperature for a certain distance upward, above which the temperature remains approximately constant as far as the highest ascents of sounding balloons have carried thermometric apparatus.

Hence, above any given spot on the earth's surface the air is coldest just below the region of the upper inversion, which marks the beginning of the great isothermal layer (or, as it is now called by its discoverer, the *stratosphere*).

The altitude of the isothermal layer varies with the barometric pressure at the earth's surface, with the season, and especially with the latitude. It is somewhat less over the poles than over middle latitudes and very much greater over equatorial regions than anywhere else in the world. In other words, the decrease of temperature with altitude continues to a much greater height within the tropic than elsewhere, and this explains the fact that the lowest temperature ever registered in the atmosphere was met with almost exactly over the equator, viz., —84.3 deg. C. (—119.7 deg. F.), at an altitude of 19,800 meters (about 12 miles), at Shirati, on Victoria Nyanza, August 30th, 1908.

This was one of many interesting results of the remarkable series of sounding-balloon ascensions executed in equatorial Africa by the expedition under Berson and Elias, sent out by the Royal Observatory of Lindenberg, the complete report of which has just been published by the observatory.

ENGINEERING.

Concreting is proceeding so satisfactorily at the Gatun locks that in the upper or lake-level tier, which formed the subject of recent illustrations in our columns, about one-half of the work is completed. The grand total of excavation done on the canal during April was 2,632,468 cubic yards.

In a recent paper, Rear-Admiral Bacon of the British navy, discussing the probable battleship of the future, arrives at the conclusion that the race between gun and armor, which has been going on for over half a century, has been decided, for the moment, in favor of the gun, nor is there any indication of there being a chance of improving the armor and strengthening general construction, so as to render ships reasonably immune from armor-piercing projectiles.

The fact that the excavation of the Panama Canal through the Culebra range of hills has set in motion a mass of 2,000,000 cubic yards of material, which is sliding into the excavation apparently on an inclined substratum of clay, serves to illustrate one of the many advantages of the present high level canal over one at sea level. The sea-level cut would have been carried eighty feet deeper, and the slides would have been, in all probability enormously greater. The material will have to be removed, but outside of the additional expense, no ill effects are to be apprehended.

The Hudson and Manhattan Railroad Company is to be congratulated on having introduced some all-steel baggage cars for the transportation of baggage between the several steam railway terminals served by its system. The sides of the cars are provided with roller curtains. There are also folding aprons, which can be let down to bridge the gap between the loading platform and the car. Eight loaded baggage trucks can be wheeled directly into the cars, an arrangement which eliminates much handling and trucking and facilitates quick loading and unloading.

It has been determined that the sinking of the United States floating drydock "Dewey" at Olongapa in the Philippines was due to an omission to close the intake valves. Accidents of this character occasionally occur, and one is reminded of the sinking of the "Texas" at the Brooklyn navy yard, which happened shortly before the Spanish American war. At the time of her launching, the "Dewey," 500 feet in length and 135 feet in width, was the largest floating drydock in the world. She will probably be raised intact.

Asked for his opinion regarding the probabilities of the introduction in the near future of gas engines as a motive power for driving large steamships, Sir William Henry White, for many years chief constructor of the British navy, recently stated that in his opinion the difficulty of high temperatures for the present effectually barred the way. If this problem could be mastered as to its mechanical features, it might be possible to utilize gas engines of 20,000 horse-power; but the proposals to drive battleships with gas engines "are so far only schemes."

The plan for opening a central avenue, one hundred feet wide, between Fifth and Sixth avenues from Eighth to Fifty-ninth streets which is being actively favored by Mayor Gaynor, would undoubtedly relieve the congestion on Fifth Avenue, to say nothing of providing the city with a magnificent thoroughfare through one of its most important districts. The estimated cost of forty million dollars, however, is prohibitive. There are other public improvements, such as subways, municipal buildings, and public schools, that are more urgent than this.

An extraordinary record was made at target practice recently by the new battleship "South Carolina," of eight 12-inch guns, which has been in commission only three months. Coxswain J. R. Edwards, 21 years old, who is in his first enlistment, made a record with the 12-inch guns in the vessel's No. 4 after turret of 16 bull's eye target hits out of 16 shots in 4 minutes and 51 seconds. The hits per gun per minute for the whole 12-inch battery were 1.01, and 55 of 60 12-inch projectiles hit the bull's eye. Furthermore, three of the four turrets on the ship made 100 per cent of hits.

The advantages of oil over coal were illustrated in a recent trip of the "Yale," one of the 22-knot passenger steamers which run between New York and Boston. The trials were so satisfactory that oil will be used exclusively on these ships in the future. Outside of the absence of smoke from the funnels, is the complete abolition of noise and dust due to coaling. Formerly, the "Yale" burned on a round trip 235 tons of coal, which took eight hours to get aboard; in future it will take only an hour for an oil barge to pump into the ship's tanks the 44,000 gallons of oil which will serve for the round trip. The principal saving, amounting to $500 a month, is due to the fact that eight operators do the work in the boiler room, where formerly forty-eight stokers were necessary.

ELECTRICITY.

In their tour of the Great Lakes this month, the members of the Chicago Association of Commerce will be able to keep in telephonic communication with their Chicago offices. Their steamer, the "Theodore Roosevelt," is fitted with a wireless telegraph outfit, and also with a telephone system which may be connected with land lines at the docks where the steamer puts up.

The indirect system of illumination, which consists in casting the light of a lamp against a white surface, such as a ceiling, and having it reflected and diffused thereby, is rapidly growing in favor. In order to make this system possible with the use of arc lamps an improved type of arc lamp has been devised by an English concern, in which the carbon-feeding mechanism is placed below the arc. The result is virtually an inverted arc lamp, and there is practically no obstruction to the light passing upward except for the means of suspension from the ceiling.

This fall the annual meeting of the Illuminating Engineering Society is to be held at Johns Hopkins University. Arrangements have been made for an extended course of lectures on the subject of illuminating engineering, immediately after the convention. Thirty six lectures will be given from October 26th to November 8th, and facilities are provided for practical demonstrations and laboratory work in connection with the subjects taken up. It is hoped that these lectures will result in a course of study in this branch of engineering for undergraduate technical schools. It is realized that there is a scarcity of practical illuminating engineers.

In Norway and Sweden the question of hydro-electric generation of power has recieved a great deal of attention from the fact that there are so many rivers in these countries capable of such development. Contrary to the custom in this country it is the practice in Sweden to couple generators directly with slow speed turbines. One interesting form of turbine generator consists of two wheels, the shaft of one passing through the hollow shaft of the other. The wheels turn in opposite directions, and one shaft carries the armature, while the other carries the fields of the generator. This virtually amounts to doubling the speed of the generator or reducing the number of poles. Hydraulic thrust bearings are used. At Korsnas, Sweden there are four pairs of turbines on a single shaft developing 420 horse-power. The fall is but six feet and the wheels make but 107 revolutions per minute. At Stangfjorden, in Norway, where there is a fall of 200 feet, a single wheel is used producing 3,300 horse-power running at a speed of 300 revolutions per minute.

Mention was recently made of a combined stethoscope and telephone relay, by which the heart beats of a patient in London could be heard in the Isle of Wight. In a paper read before the British Institute of Electrical Engineering, S. G. Brown the inventor described the construction of this relay. It comprises a gap of 0.000,000,5 centimeter between platinum electrodes. The current of a dry cell will flow across this microscopic break, but any slight variations in this distance will vary, greatly, the current passing across the gap. The principal difficulty encountered was the question of preserving a gap of such microscopic proportions. It was evidently impossible to maintain the gap mechanically, but a system has been devised whereby the gap is automatically maintained by the current itself. Despite the delicacy of the adjustment, the relay may be turned upside down without affecting the gap. With this relay the fluctuations in feeble currents may be magnified twenty fold. An illustrated description of this relay and stethoscope will be published in next week's issue of the SCIENTIFIC AMERICAN.

The wireless telegraph station which has been recently erected by the French government on the Channel coast at Boulogne is of interest from the fact that it represents the first official application of the Bellini Tosi system of directed waves. The new plant at Boulogne is operated by the French Postal and Telegraph department and is laid out so as to be operated either by the usual method or by the Bellini Tosi system. Accordingly the plant has an ordinary vertical antenna and an antenna for directed waves. These aerial systems are supported by four structural iron towers 165 feet high placed at the corners of a 260 foot square. Four cables connect the tops of the towers, and the Bellini-Tosi antenna consisting of two groups of wires, is suspended from these. Each group is formed of two vertical antennæ converging towards the top, each having six parallel wires spaced 13 feet apart. These antennæ form a triangle with a horizontal section near the ground and two inclined wires. At the top the antennæ are 260 feet apart and at the bottom 420 feet. The new station is working with the French stations of Saintes-Maries, on the Mediterranean coast, and also with the Algiers post.

SCIENCE.

Prof. Eduard Friedrich Wilhelm Pflueger, who died on March 17th at the age of 81, at the end of over sixty years of single-minded and unswerving devotion as a student of physiology, was best known to the scientific world by the 131 volumes of Pflüger's Archiv. To that monumental publication many a distinguished scientist has contributed. Pflüger himself made a special study of the mechanism of spinal action in the frog and the law of reflex action as studied upon the decapitated animal was one of his earliest investigations. His work on physiological consumption in living organisms has played an important part in our knowledge of the chemical respiration of the tissues.

During the past three months the United States Weather Bureau has introduced a simplified form of weather map, known as the 'commercial weather map,' for publication in the daily newspapers, and this now appears regularly in about forty papers. This is an innovation of far reaching importance as it gives a much wider circulation to the information contained in the map than it has had heretofore. While the matter is still in the experimental stage, it appears altogether probable that the newspaper maps will ultimately replace the maps now published by Weather Bureau stations throughout the country resulting in a great saving of expense to the government and the advantage to the public above mentioned.

Prof. Kronacher has studied the power of yohimbin to increase the flow of milk of cows and sheep. The results prove that the yield of milk is increased during the administration of yohimbin, but the increase is not sufficient to make an extensive use of yohimbin as a galactogogue commercially profitable in the case of healthy animals. In the case of a cow, whose yield of milk was diminished by an inflammation the disease was greatly mitigated by the treatment, and an increased yield of milk followed. Many similar instances were observed. In no case did any injurious results follow the administration of the medicine. No experiments have yet been made on the influence of yohimbin as a galactogogue in the human species. In this case the question of expense is of less relative importance and the favorable results obtained with animals appear to promise a successful outcome.

The alloys of iron with metals other than those which enter into the composition of cast iron and steel have been little studied. In order to ascertain if any of these alloys possess useful electrical properties, Burgess and Aston have made a series of experiments with alloys of iron with arsenic bismuth, and antimony. The iron which they employed was obtained by the electrolysis of very pure Swedish iron. The metals were melted together in the electric furnace in a crucible of magnesia. The alloys were cast into bars which were subjected to various thermal treatments, and were investigated for magnetic permeability and hysteresis. The results show that the presence of antimony in iron always injures the mechanical strength of the metal, and sometimes makes it worthless. Small quantities of arsenic improve the magnetic properties of iron and increase its electrical resistance. Bismuth produces the same effect but it must be added in larger quantities than arsenic.

"The sun glows in the Lion" says Seneca meaning that when the sun enters the sign of Leo, at the summer solstice the highest temperature of the year is experienced. We may say, on the other hand that the Babylonian astrologers thousands of years ago placed the king of beasts the fiery and ferocious lion in that part of the zodiac which the sun enters at the summer solstice. The constellation which is called Leo bears very little resemblance to the outline of a lion. Probably the name was originally applied only to its principal star, Regulus. It is to this constellation in the zodiac that we owe the countless water-spewing lions' heads, which are found in ancient and modern fountains, because in the latter part of July, while the sun is still in the sign Leo the Nile is at its highest level. Furthermore the lion's head with widely open jaws is in itself very suitable for the mouth of a fountain or water spout. This decorative *motif* was employed universally throughout the Greco-Roman world. Lions heads are found used in this way at Athens Ephesus Olympia Agrigentum, and countless other places. It is not quite certain that this employment of the lion's head originated in Egypt, Curtius describes an Assyrian bas-relief from Bairan, showing water streaming from a ring-shaped vessel. A lion stands as if on guard on either side of the fountain. The water clock, which was used in judicial proceedings, had the form of a lion and a name which means the guardian of the stream. Hence the idea of protection may have been the origin of the association of lions with fountains, and this custom may have originated in Asia.

THE OCEANOGRAPHIC MUSEUM AT MONACO

BY DR. ALFRED GRADENWITZ

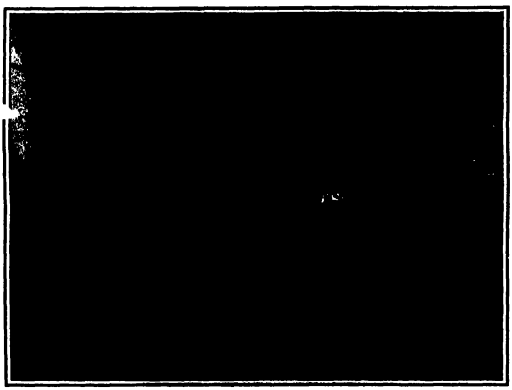
The Prince of Monaco besides being the ruler of one of the smallest though most charming countries, has achieved fame in the world of science, has endowed his principality with a scientific institute unique in its kind, viz, an oceanographic museum destined to contain not only the enormous collections brought home from his own voyages of discovery, but, generally speaking, everything relating to the investigation of the sea and its inhabitants, animal and vegetable

This museum which was solemnly inaugurated some weeks ago is situated in a site of surpassing beauty on a precipitous rock dominating the Mediterranean, close to the famous St Martin Gardens thus allowing of the installation of two basement stories, which open immediately on the sea for the sake of certain scientific investigations The foundation works of the building had obviously to be most elaborate, the more so as some of the pillars start nearly from the level of the sea

The building, 100 meters in length, is of a most imposing appearance, and is a masterpiece from an architectural point of view Each of its monolith columns 8 meters in length, is 16 tons in weight Most of the motives of decoration are derived from the fauna of the ocean

When entering the ground floor, we are at first struck by the imposing mosaic floor, on which is represented—likewise in mosaic—the Princesse Alice, the yacht on which the Prince has achieved his most important scientific cruises Everywhere around the hall are seen ornamental subjects representing fishes and other inhabitants of the ocean On both sides a monumental staircase leads up to the first floor

The museum of Monaco.



Skeletons of whales, narwhals, and other ocean giants.

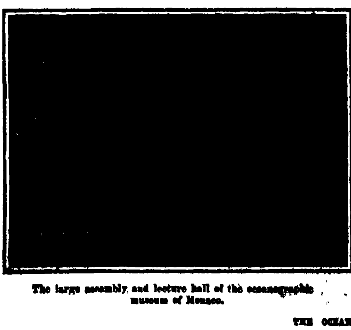
After passing through a huge glass-paned door, we enter a large assembly hall, 7 meters high, adorned with four beautiful columns of Brescia limestone, from the ceiling of which is suspended in the center an electric luster representing a medusa, whereas each of the four angles is taken up by a smaller luster forming a glass sphere adorned with long prisms reminding of sea anemones, star fishes, and other radiata In front is seen a large statue of the Prince, representing him on board his yacht searching the horizon

The western hall is set apart for lectures, congresses, and other assemblies, a large part of its back wall being taken up by an artistic painting representing the 'Princesse Alice on an intensely blue and somewhat agitated sea.

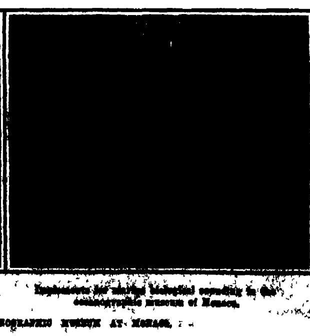
The eastern hall is taken up provisionally by sundry collections of zoological subjects and oceanographical instruments, but is destined particularly for the collections brought home from the Prince's voyages, which include the rarest and most beautiful specimens. In fact, the wonderful equipment of the "Princesse Alice has allowed the sea to be searched down to a depth of more than 6 000 meters, while four expeditions in Arctic districts, beyond 80 deg northern latitude, have yielded specimens of the Arctic fauna, suggestive of the most interesting comparisons with those of the Mediterranean and the Northern Atlantic respectively

Whereas these zoological collections are housed in the right hand half of the hall, the exhibits on the

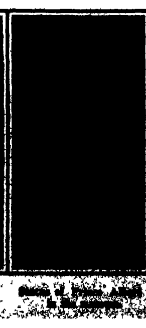
(Concluded on page 489)



The large assembly and lecture hall of the oceanographic museum of Monaco.



Implements for marine biological sounding in the oceanographic museum of Monaco.



Statue of Prince Albert in the museum.

THE OCEANOGRAPHIC MUSEUM AT MONACO.

THE NAM-TI BRIDGE

A REMARKABLE NEW RAILWAY BRIDGE IN SOUTHERN CHINA

The Yunnan Railway Company is completing the construction of a line which will connect Laokay, a frontier town of the French Asiatic possessions, with Yunnansen, the capital of Yunnan, and will be of great importance in developing the commerce of Indo-China and Tonkin. The construction of this railway through one of the most tightly closed provinces of China has been greatly impeded by the climate, the difficulty of transportation and the incompetence of native workmen. Owing to these difficulties, the original plan of crossing most of the streams by means of stone viaducts was abandoned after a few unsatisfactory experiments, and it was decided to employ, as far as possible, steel bridges, of various types to suit local requirements, and so designed that they could be constructed in parts at the Batignolles works in Paris, forwarded to their destinations, largely by rail, as the line advanced, and quickly put into place. The bridge thrown over the Nam Ti River and the peculiar methods employed in its construction are here described and illustrated. At this point the river flows through a deep gorge between nearly vertical cliffs which the railway pierces by means of two curved tunnels, at a level more than 300 feet above the bed of the stream. The width of the chasm at this level of the railway is about 220 feet. In these conditions the construction of a simple truss bridge of a single span would have entailed much labor expense and delay, owing to the necessity of working underground and of greatly enlarging one of the tunnels in order to obtain room for the partial assembling of the heavy and deep truss required. It was desirable, furthermore, to begin the construction of this comparatively large bridge before the railway had been extended to the gorge, in order to avoid any interruption in the progress of the line. Consequently, owing to the entire absence of wagon roads, the greater part of the material and machinery had to be carried a considerable distance on the backs of mules and men, in parcels not exceeding 8 feet in length or 175 pounds in weight. These considerations determined the choice of the type and method of construction shown in the accompanying illustrations.

The superstructure of the bridge is composed of [illegible] independent [illegible] trusses, the ends of which [illegible] abutments at the mouths of the tunnels and on three intermediate supports [illegible] by the [illegible] of [illegible] supporting trusses of triangular profile and by two [illegible] which rise from the [illegible] of the [illegible]. The lower ends of the supporting [illegible] on abutments constructed on artificial ledges on the walls of the gorge about 60 feet below the railway. The distance between these abutments is about 180 feet, but the total length of the superstructure of the bridge is about 220 feet.

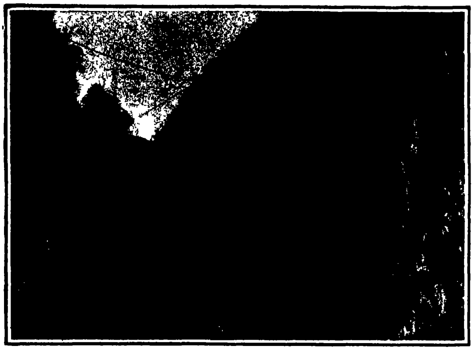
The supporting trusses were shipped from France in parts small and light enough to be carried by men and mules, while the upper trusses, the pylons and the joint connecting the supporting trusses were sent out in riveted sections of comparatively great size and weight which could be transported only by rail, as it was designed to have the railway completed to the gorge by the time the construction of the supporting trusses would be finished.

The supporting trusses are attached to their abutments as they are to each other by movable joints. They were assembled in nearly vertical positions and their upper ends were subsequently lowered until they met.

Each of the supporting trusses is composed of two single triangular trusses the planes of which are inclined symmetrically to the vertical at angles of 14 degrees. These trusses are about 25 feet distant from each other at their lower and outer ends and about 11 feet at their upper and inner ends. The straight bottom chord of each single truss is composed of two vertical plates about 2/5 inch thick and 14 inches deep separated by an interval of 10 inches suitably connected and stiffened by L-bars or angle plates. The top chord, which forms a broken line, is of similar construction but variable section, and is reinforced above by transverse plates about ½ inch thick. The truss is completed by pairs of light L-bars placed normally and obliquely to the bottom chord. The two single trusses of each supporting truss are connected by cross braces in the planes of the normal bars and in the three planes of the bottom and top chords.

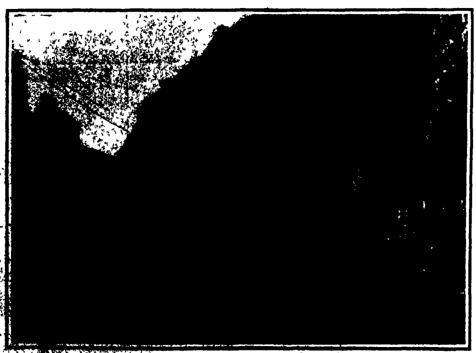
The lower and outer end of each single truss is supported on a stone pier by means of a ball-and-socket joint of steel. The concave member of the joint is attached to the truss, the convex member is fitted to the pier by means of a bed plate and adjusting wedges. The radius of curvature of the joint is about 6 inches. The upper and inner ends of the trusses are connected by hinge joints having pins of forged steel, 7 8 inches in diameter. These pins are perpendicular to the planes of the single trusses and consequently, are not horizontal but the amplitude of oscillation is so small that this slight inclination does not impair the freedom of the joint.

Although the weight of the bridge is sufficient to insure transverse stability in the



Beginning the lowering of the supporting trusses

The supporting trusses lowered half-way.



The supporting trusses lowered to their final positions.

THE NAM-TI BRIDGE.

strongest winds, additional resistance is given by steel bars attached to masonry anchorages and to the rock.

The superstructure of the bridge is composed of two terminal spans 51 6 feet and 71 7 feet long, and two intermediate spans each 48 2 feet in length The trusses have a uniform depth of about 6½ feet The floor beams which connect the top chords of the two single trusses are 16 inches deep and about 1/3 inch thick

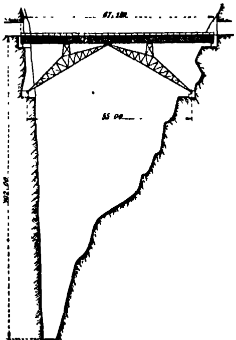
The most interesting feature of the Nam-Ti bridge is the method by which it was erected Before the various parts of the supporting trusses had reached the tunnel nearest the French possessions a windlass was set up over the mouth of each tunnel and the cables of these windlasses were joined together so that material suspended from the junction could be carried across the gorge by unwinding one cable and winding up the other

The supporting trusses were partly assembled into a few large sections in the tunnels These sections were then hoisted to their proper places in the trusses which were erected in a nearly vertical position and supported by the ball and-socket joints at their lower ends and by temporary stays and timbers The terminal section of the truss, including the socket, was first placed in position on the ball of the joint, which was anchored securely to the rock The outer halves of the upper chords with the ties and braces lying in their common plane, were next erected The rectangular frame thus formed, which leaned against the cliff and was also stayed by ropes and timbers was then attached to the interior of the tunnel by two tackles strong enough to prevent it from being dragged forward by the weight and leverage of the remaining parts as they were added, and to maintain the completed truss in its vertical position This frame then served as a scaffold for the assemblage of the bottom chords of the truss and their attachments In this position of the truss the bars which are perpendicular to the bottom chords were so nearly horizontal that they formed convenient supports for the few planks on which the workmen stood After the bottom of the truss had been completed the inner halves of the top chords were assembled in the same manner some of their auxiliary parts being temporarily omitted in order to lighten the inner ends of the truss The parts were temporarily joined by means of lathe-turned bolts in order to secure the greatest possible precision, but the construction of the supporting trusses was so far in advance of that of the railway that it was found possible to replace most of the bolts by rivets before the track had been extended to the gorge Meanwhile in order to save time, a file of coolies, marching five feet apart, carried through the tortuous mountain passes for more than 12 miles, the two heavy chains, each 900 feet long, which were employed in lowering the supporting trusses to their final positions The other machinery required for this purpose, as well as the sections of the upper table of the bridge, was brought by rail

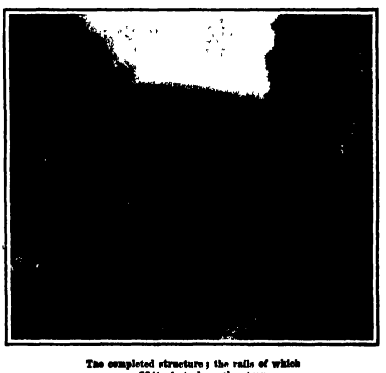
The lowering was accomplished by means of two great pulley blocks, anchored to the face of the cliff above the tunnels and connected by the two long chains with two similar blocks attached to the upper ends of the trusses. The chains were first drawn taut in order to slacken the temporary tackles attached to the interior of the tunnels and allow their removal The chains were then slowly paid out, by means of windlasses provided with brakes, allowing the two trusses to turn around their outer ends, like the halves of a bascule drawbridge, until their inner ends came together In order to facilitate this operation, both trusses carried sights at their inner end, and one of them, which was lowered a little after the other, bore both parts of the hinge joints by which the trusses were to be connected

The omitted parts of the trusses were then added, a bed plate was constructed over their junction, and a pylon, which had been partly assembled in frames of two posts, was erected over the middle of each truss.

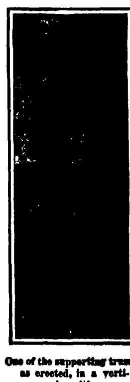
The upper table of the bridge was assembled, as a continuous truss, in a straight and not very long excavation in the first tunnel As its construction progressed it was moved forward with the aid of rollers placed on the two pylons and the junction of the supporting trusses until it had been completed and its forward end had reached its abutment on the opposite side of the gorge The connections between the four spans were then removed The construction of the bridge was commenced in March, 1908, and was completed in November of the same year —G Bodin, in Le Génie Civil



Side view of the bridge and section of the gorge, with dimensions in meters



The completed structure; the rails of which are 331¼ feet above the river.



One of the supporting trusses, as erected, in a vertical position.

THE NAM-TI BRIDGE.

At the Höganäs coal mines in the south of Sweden, states the Iron and Coal Trades Review experiments have been carried on for some time with the smelting of fine iron ore by means of Swedish coal These experiments were at first conducted with a Gröndal furnace using coal of an inferior quality, for which it was desired to find an outlet Later the chief director of the Höganäs coal mines undertook to conduct the experiments independently, and it appears that he has now obtained favorable results, and that sufficient data have been collected to allow of exact calculations and estimates being made. The owners of the Höganäs coal mines—the Billesholm Aktiebolag—have, in consequence, resolved to build a furnace with a capacity of 15,000 tons of fine iron ore per annum. When this furnace has been tested in practice with the view of discovering possible faults, the intention is to erect nine other furnaces of the same size and capacity.

Recent Spectroscopic Study of the Sun.

The physical interpretation of the changes produced in the lines of the solar spectrum, by terrestrial weather conditions and by passing from one to another point of the sun's disk, is still under discussion Whittaker refuses to attach any definite significance to changes of temperature occurring in the stormy solar atmosphere, nor does he admit that the peculiarities of spark spectra are characteristic of elevated temperatures. Electric vibration of atoms may be excited in a cold gas, as is proved by the aurora. Whittaker attributes the observed changes in the spectrum to great pressure. Cortie and Evershed, on the other hand, defend the usual interpretation, which attributes the changes to high temperature, radial velocity and chemical action Evershed does not admit that pressures much greater than atmospheric can exist in the sun, even at the bottom of the reversing layer This opinion is based upon the sharpness of spectral lines in general But the hypothesis implies that in the sun gravitation is everywhere opposed by repulsive forces.

Until recently the spectro-heliograph was applied chiefly to the lines H and K. Thus were obtained images of the flocculi, those bright clouds of calcium vapor which almost cover the sites of the spots and faculæ Since 1908, following the example of Hale, the red line of hydrogen, which shows entirely different forms, has also been employed. This has led to the discovery of long dark filaments, which normally persist for several weeks, but which sometimes disappear or change rapidly near very active spots According to Deslandres these filaments represent tornadoes with horizontal axes They are exhibited especially by the middle part of the line $H\ \alpha$, which corresponds to the upper limit of hydrogen vapor The marginal portions of the same line show dark flocculi, which are reversals of the calcium flocculi

The photographs made by Hale, at Mt Wilson, with this same line, show the spots surrounded by cyclonic structures, which exhibit opposite rotations in the north and south hemispheres These spirals are far less frequently observed in ordinary photographs Can they be trajectories of material particles? The first evidence, furnished by Hale, consists in the doubling and the polarization of the spectral lines in the interior of the spots These phenomena suggest the circulation of electrified matter in a magnetic field Evershed sought further evidence by placing the slit of the spectroscope across a spot near the sun's limb In this case radial velocities in opposite directions should be found on opposite sides of the spot Instead of this, however, Evershed found numerous and persistent indications of a tangential movement, always directed from the center of the spot These results were obtained chiefly with the lines of iron Possibly both movements coexist at different levels, the whirlwinds in a stratum of hydrogen, the centrifugal flow in metallic vapors beneath

Secchi, who discovered that the dark lines of the solar spectrum become bright or reversed in a narrow stratum at the base of the chromosphere during a total eclipse, contended that this reversal could be observed at ordinary times Hale and Adams have confirmed his view by photographing the reversed spectrum Their success appears to be due to the very delicate adjustments which enabled them to keep the slit of the spectroscope accurately tangent to the sun's limb. The wave lengths of 184 of the lines were measured and were found exactly equal to those of the corresponding dark lines of the ordinary spectrum. This perfect agreement could not be expected if, as Julius suggested, the bright lines are due to the light of the photosphere, affected by anomalous dispersion.

To blacken light woods make a preparation of an ounce of borax, dissolved in a quart of water, with two ounces of shellac. The liquid is then to be boiled until a perfect solution is obtained, then stir in two teaspoonfuls of glycerine, and complete by adding a sufficiency of soluble aniline black to completely darken the liquid, which will now be ready for use.

Instruction in Aeronautics at the University of Paris.

A Chair of Aeronautics has been established at the University of Paris by M. Basil Zaharoff, and is occupied by Prof. Marchis, who has announced the programme of his course of lectures. The professor begins by replying to the criticism that M Zaharoff's endowment would have been employed far more usefully for the development of aerial navigation if some direct encouragement had been given to constructors, who are compelled to make very costly researches, or to the brave aeronauts who risk their lives in these experiments The empiricism which necessarily rules in the beginning of every industry should now be superseded by a methodical and rational interpretation of observed facts. The object of this lecture course will be to expound as logically as possible the results which can fairly be considered as certain. Without entering into very recondite theoretical considerations, the lectures will still be far from "popular" or elementary Finally, the development of the special aeronautic library already possessed by the University, and the formation of a collection of small models of aeroplanes and dirigible balloons, will supplement the instruction given by the lectures. The professor will not confine his attention to theoretical speculations and laboratory researches, but will follow in detail the experiments of constructors and the trial flights of aviators, noting in each case the progress achieved and endeavoring to account for the failures

Scientific American Prizes for Inventors.

The SCIENTIFIC AMERICAN offers $100 in three prizes, to be awarded to the inventor who gives the best account of how he conceived his invention, how he developed it in actual practice, and how he succeeded in selling it This sum of $100 to be distributed as follows $50 to the best account, $35 to the second best account, $15 to the third best account.

There is no limitation as to subject matter of the invention In other words, the invention may be a household utensil, a game, a piece of electrical apparatus, an improvement in railway construction, a metal lurgical process, etc. The following conditions, however, must be observed

1 The invention must be patented

2 The inventor must have actually sold his patent, and the invention must have been commercially introduced

3 The account of the inventor's success must not be longer than 800 words.

4 The composition, letter, or article must be typewritten on one side of the paper only

5 The inventor must sign his offering with a pseudonym, and inclose it in a sealed envelope, upon which the pseudonym is written A second sealed envelope must be provided, bearing on the outside the pseudonym under which the offering is submitted, and containing the real name and address of the contestant

6 Contestants must address their offerings to Inventors' Prize Editor, SCIENTIFIC AMERICAN 361 Broadway, New York city

7 The contest remains open until August 15th, 1910 Judges will select the essays which, in their opinion, have won the three prizes and give them to the Editor of the SCIENTIFIC AMERICAN, who will thereupon open the sealed envelopes containing the true names of the contestants, and notify the winners of the prizes

8 The Editor of the SCIENTIFIC AMERICAN has the right to publish the prize winning articles or letters as well as those which may not receive prizes

9 Unsuccessful letters cannot be returned It is thereupon urged that the contestants preserve copies of their contributions.

Official Meteorological Summary, New York, N. Y., May, 1910.

Atmospheric pressure Highest, 30 40; lowest, 29 46, mean, 29 96 Temperature Highest, 81; date, 24th, lowest, 44, date, 5th, mean of warmest day, 71, date, 29th; coolest day, 52, date, 5th and 15th, mean of maximum for the month, 67 6, mean of minimum, 52.8, absolute mean, 60 2, normal, 59.3, average daily excess compared with mean of 40 years, 0 9 Warmest mean temperature of May, 65, in 1880, coldest mean, 54, in 1882 Absolute maximum and minimum of May for 40 years, 95 and 34 Average daily excess since January 1st, 3 4 Precipitation 1 66; greatest in 24 hours, 0 65, date, 20th and 21st; average for May for 40 years, 3 18. Accumulated deficiency since January 1st, 1 38 Greatest precipitation, 9 10, in 1908, least, 0 33, in 1903 Wind, Prevailing direction, northwest, total movement, 8,311 miles, average hourly velocity, 11 0; maximum velocity, 38 miles per hour. Weather Clear days, 8, partly cloudy, 9; cloudy, 14; on which 0.01 or more of precipitation occurred, 11. Mean relative humidity, 64.6. Dense fog 8th, 9th, 23rd, 30th; thunderstorms 9th, 14th, 21st, 30th Mean temperature of the spring, 52 97, normal, 48.30. Precipitation of the spring, 7.06; normal, 10.58.

Correspondence.

REDUCTION-GEAR TURBINE TESTS.

To the Editor of the SCIENTIFIC AMERICAN

Your article "A Way Out of the Marine Turbine Dilemma," in your issue of the 12th of February places before the general reader throughout the world an epoch-making invention There can be little doubt as to its great value, and any discussion that hastens the proof thereof may be welcome

You refer to the difficulty of ascertaining the actual horse-power of a turbine as a factor of uncertainty in the calculation of the efficiency of the combination, and suggest that a reliable check upon the results given is afforded by computations based on the rise of temperature of the oil But the heat causing this rise of temperature is, at the same time, communicated to the large surrounding masses of metal, and the heat thus taken away from the oil should be calculated, if possible, or allowed for

There is another way less open to question for measuring the loss of power due to friction Let the driven shaft be made the driver at 300 revolutions per minute by a reciprocating engine directly coupled thereto, so that the pinion shall be driven It will then be easy to apply a brake to the pinion shaft, and ascertain the power transmitted upon a definite basis of comparison with the power exercised on the other shaft

The results of such a reciprocal test will not merely be "well within reason" but will convince the world They will certainly be most satisfactory, but below an efficiency of 98 5

G STRICKLAND

Perth, Western Australia.

The Safe Knot in Case of Fire.

To the Editor of the SCIENTIFIC AMERICAN

In your issue of May 28th, page 441, is a figure which would be liable to lead to harm if followed in case of fire The right hand upper illustration shows a "granny" knot, which is a loose or slipping knot The one which should be used is the "square' knot, in which the end and strand both pass *below* the loop, or both above it, instead of one above and one below as shown The square knot will not slip

F H HALL.

[There can be no doubt that our correspondent is

THE CORRECT WAY OF TYING

correct. The "granny' knot would be unsafe for the serious use to which it would be subjected in case of fire We therefore publish the foregoing diagram in order to correct any liability to mistake —EDITOR]

New Cometary Theories.

Neither the comets seen for the first time in 1909, nor the periodic comets of Perrine and Winnecke which reappeared nearly in their computed places, offers any special interest Halley's comet reappeared in the position calculated by Cowell and Crommelin It was first detected in a photograph made by Wolf, at Heidelberg, on September 11th but was subsequently found on a plate exposed by Keeling on August 24th Its brightness increased slowly until the end of the year Its spectrum, first observed in December, showed the absorption bands of nitrogen and cyanogen, with indications of self luminosity due to incandescent gases

The past year is marked especially by the results of the retrospective study of the spectroscopic and direct photographs of Morehouse's comet (1908 *C*), which was barely visible to the naked eye This comet exhibited several divergent bright tails accompanied by streamers darker than the sky, as if the space surrounding the comet were filled with luminous matter Subsequently, the tails bent and crossed, and Melotte observed a diminution of brightness at the point of intersection, as if one tail absorbed the light of the other Several times the tail appeared to break up into knots, which formed new envelopes and moved away from the head with increasing velocity Comparison of successive photographs showed that the compound tail opened and closed as if the whole structure were rotating about a central axis. The stereoscopic combinations made by Barnard appear to indicate the presence of tails of helical form, but Barnard suggests that this effect may be due to changes of form in the intervals between exposures Crommelin observes that the apparent rotation of the tails may also be an illusion It is sufficient to suppose that the head rotates slowly and projects particles rapidly in a plane which follows the rotation If the tails represent the trajectories of particles, forces emanating from the head and from other points must co-operate with solar attraction and repulsion The occurrence of four successive outbursts of activity suggests the influence of a medium of variable constitution, formed by particles ejected by the sun and made visible by the passage of comets, either by electrification or by carrying cometary matter with them This hypothesis would explain the presence of cyanogen and certain other lines in the spectra of nearly all comets On this theory the apparent boundary of a comet's tail like that of a flame, would be simply the locus of a change of physical state

In the spectrum of this comet, E C Pickering found six absorption bands corresponding to the principal lines of hydrogen At Meudon and Juvisy a faint continuous spectrum indicating self luminosity, was observed Deslandres regards the three pairs of bands as doubles, due to the Doppler effect and deduces for the cometary matter a velocity of more than 1,200 miles per second but the presence of a strong single line in addition, leads Campbell and Albrecht to reject this interpretation

The Current Supplement.

A thoughtful yet popularly written article on Heredity by Prof W E Castle of Harvard University opens the current SUPPLEMENT No 1797 The article shows that before any serious attempt can be made to improve the human race considered as an assemblage of animals possessed of certain desirable physical and intellectual attributes it is obvious that we must know something about heredity in general and how, in particular each of the desired physical and intellectual attributes is produced In his article he reviews briefly some of the problems which the study of heredity presents and some of the results obtained from their consideration —Sir William Crawford concludes his excellent consideration of Irish linens and their manufacture —Shellac or lac is one of those aids to civilization about which there has tended to be an atmosphere of mystery and romance Mr G Clarke Nugent removes much of this mystery in a strictly scientific account of shellac and the lac industry — A Roze's instructive article on how to build a profile puppet show is concluded —A critical consideration of the Mallet locomotive in service is published —The chemical regulation of the processes of the body by means of activators, kinases, and hormones is discussed by Prof William H Howell of Johns Hopkins University —Mr William E Stark's paper on Measuring Instruments of Long Ago is concluded —We are very apt to regard the tail of an animal as merely "the other end" of the body but Nature seems to have early esteemed the member highly and to have made it her most efficient instrument of locomotion Many curious facts about these uses of tails are described by Mr James Newton Baskett —Mr W F Denning summarizes our knowledge of the planet Mercury — The usual Electrical Notes Engineering Notes and Trade Notes will be found in their accustomed places

Wanted: Information About Dishonest Patent Schemes.

The SCIENTIFIC AMERICAN has always made a practice of exposing the snares and devices of the patent promoter as well as the fraudulent patent attorney Although the subject is by no means new to the readers of the SCIENTIFIC AMERICAN it is one of which all inventors should be thoroughly informed The Editor of the SCIENTIFIC AMERICAN would like to receive from readers of this journal, letters in which they narrate their personal experiences with dishonest promoters and attorneys Such letters will be published in due course and should not only be of interest in themselves but should serve as a warning, thereby protecting others against such snares.

Antique Siamese Bronze (Without Bronze Powder) —This is a greenish-black coating, with inlay of green patina Rub chrome green and zinc white to a greenish white color with turpentine oil, mix with copal varnish and apply to the object, coating the hollow portions especially If there is rich decoration coat this all over and dry Now rub green cinnabar graphite, and some black pigment to a greenish black color with turpentine oil mix with copal lacquer and coat over all the raised portions leaving the hollows untouched, so that the first layer in the hollow portions will have the appearance of copper oxide. Glaze after drying, with spirit lacquer Handle the brush just as in ordinary bronzing

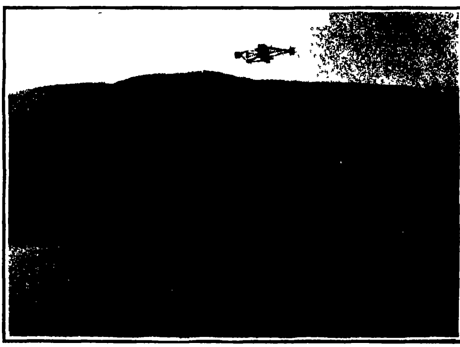
THE ALBANY-NEW YORK AEROPLANE FLIGHT

HOW CURTISS COMPETED FOR THE SCIENTIFIC AMERICAN TROPHY AND THE NEW YORK WORLD PRIZE

OF the three attempts that have been made to fly from New York to Albany, or *vice versa*, the first two were made last fall by dirigible balloons, and were unsuccessful, while the third attempt was made recently by an aeroplane, and resulted in a brilliant prize-winning flight.

The New York World, which so generously donated a prize of $10,000 last summer for the performance of this feat during the Hudson-Fulton celebration afterward extended the time within which it could be competed for to October 10th, 1910. Only a few weeks ago after the exciting aeroplane race of Paulhan and White from London to Manchester England, for the $50,000 prize of the London Daily Mail it was decided to amend the rules and permit the making of two stops *en route*, while the time limit for the completion of the trip was set at 24 hours. As soon as the modifications were announced, Glenn H. Curtiss, the first winner of the Bennett cup race in France last year and twice the winner of the SCIENTIFIC AMERICAN Trophy, began experiments with a new and powerful biplane at Hammondsport N. Y., with regard to landing upon water. He had already experimented last fall upon rising from the water, and, although unable to accomplish this, had attained a speed of 20 miles an hour with his small biplane resting on pontoons and driven by its air propeller and 25 horse-power 4-cylinder Curtiss aeronautic motor. It was therefore a comparatively easy matter to fit his new and larger biplane with cylindrical floats and an air-tight canvas bag running the length of the wood strut that connects the front and rear wheels. After making a number of flights over Lake Keuka, at Hammondsport, N. Y., and landing successfully upon the water, Mr. Curtiss shipped his aeroplane to Albany and took a prospecting trip on the steamboat from the capital to the metropolis. He found practically no suitable landing places on the river banks throughout the entire journey. At Poughkeepsie, however, a mile back from the east shore, he selected a landing place on the farm of Mr. W. F. Gill. Upon reaching New York Mr. Curtiss gave notice that he would attempt to win the cash prize of the World and also the SCIENTIFIC AMERICAN Trophy for the third consecutive time, which would give him the cup permanently. He then returned to Albany to superintend the assembling of his biplane. This was accomplished in a tent pitched upon Van Rensselaer Island, a mile south of the railroad bridge at Albany. A heavy rain caused delay in assembling the biplane and kept the aviator from starting on Thursday, May 26th, while Friday the flight was impossible of accomplishment because of strong wind. Early Saturday morning Mr. Curtiss went to the island. Everything was in readiness for the flight, and the weather appeared to be perfect, but just as the aviator was about to start a wind sprang up, and he was obliged to again postpone his attempt. Sunday morning dawned bright and clear without any signs of wind, and after waiting till 7 A. M. to see if the wind would increase, Mr. Curtiss started three minutes thereafter. Circling to the north so as to pass within the city limits of Albany just below the railroad bridge, the aviator headed down the river at a 50-mile clip against a wind of 4 or 5 miles an hour velocity. He rose quite rapidly to a height of 1,000 feet, and followed the course of the river for 75 miles to Poughkeepsie. As he came in sight of the railway bridge at this point, he was flying at an elevation of about 500 feet. He increased his height somewhat as he neared this 212-foot-high structure, which he passed several hundred feet above. Three miles beyond the bridge he turned inland on the east side of the river, and landed at 8:26 on the field at Camelot which he had previously selected. The 74½ miles had been covered in 1 hour and 23 minutes at a rate of more than 52.63 miles an hour. The special train which [illegible]

Just before the start at Albany.



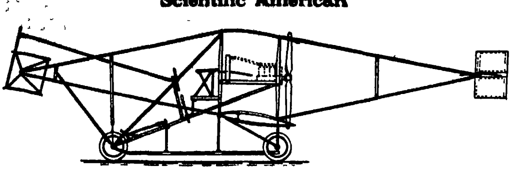
The biplane passing over Iona Island, the government explosives manufactory.

Curtiss planing down the Hudson at 50 miles an hour.

Photos copyright 1910 by Pictorial News Co.

The landing at Governor's Island, N. Y.

THE ALBANY-NEW YORK AEROPLANE FLIGHT.



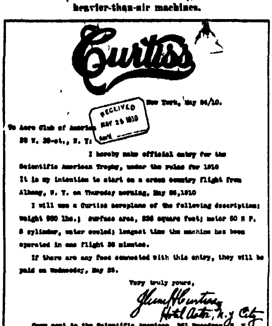
Side elevation of Curtiss biplane, showing relative positions of planes, rudders, etc

... parallel with him almost the entire distance to Poughkeepsie. After he landed, however, he was obliged to send for gasoline and oil, in order to replenish the tanks of his biplane before continuing the journey. This necessitated a stop of one hour At 9:26 A. M. he re-started on his eventful flight and, soaring out over the river, he headed toward New York at a somewhat slower gait than before, owing to the curves and wind. During the balance of the journey, he maintained a height of from 500 to 800 feet. He did not fly as high as during the first part, since, in passing through the Highlands, he found that it was better to fly at a lower elevation Upon reaching Newburg Mr. Curtiss could see from the smoke that the wind had changed and was blowing from the west, or directly across his course. As the velocity was not great, however, this did not cause him any uneasiness.

Soon after passing Storm King, the 1,530-foot mountain that juts out into the river just above West Point, the daring aviator experienced a sudden down draft of air that caused the machine to drop so rapidly that it seemed to fall away beneath him At the same time, it tipped at a sharp angle to one side, owing to one end catching more of the downward current. With great presence of mind Mr Curtiss directed his front horizontal rudder sharply downward, in order to gain speed by making a dive and thus to enable his balancing planes to become effective, which, of course, they were not when in a current of air traveling perpendicular to them This maneuver was successful, and he was able to right the machine Save for this once, he had no thrilling experiences He passed over Iona Island, near West Point, as shown in one of our photographs, but for the greater part of his trip he followed the middle of the river He made a practice, however, of keeping to the leeward side of the river as much as possible Thus, when Peekskill was reached, and he found that the wind had again shifted so that it was blowing from the northeast, he crossed over to the Jersey side, and followed the stream above the Palisades. When Spuyten Duyvil was reached, noticing what seemed to be a smooth, grassy field, he circled about and retraced his course for a short distance in order to land upon it. He was somewhat amazed, upon landing, to find that what had appeared from his considerable height to be level ground, was in reality a fairly steep incline, so that it was necessary for him to jump out of his machine the moment it came to a standstill, and to hold it from sliding back down the hill Afterward, when assistance arrived, he pushed the machine to the top, where there was a sharp terrace, and after making a stop of over an hour, he started off this terrace after a very short run. The machine soared off the terrace without dropping to any great extent, showing the possibilities of starting from a cliff

Mr Curtiss's second stop was occasioned by the discovery that his lubricating oil was almost gone By landing upon the north end of Manhattan Island, he would accomplish the flight from Albany to New York with but one stop, while two were allowed. Therefore, so as to make sure of winning the prize, he made the short detour and landed at 10 35 A. M — one hour and nine minutes after his start from Poughkeepsie The distance covered in this second stage was, over the course followed, 53¾ miles, so that the speed was 46¾ miles an hour The remaining 14 miles to Governor's Island was covered in 22 minutes, the second start being made at 11 42 A. M, and his arrival in front of the shed constructed for him last fall taking place a few minutes after noon On this last stage of the flight, Mr Curtiss maintained a height of approximately 500 feet. He descended rapidly as he neared Governor's Island, and skimmed over the sandy stretch of made land at a height of about 15 feet, almost till he reached the shed. One of our photographs shows him a minute or two after he alighted. At Spuyten Duyvil he left off the two cylindrical floats—one on each side of the machine below the lower plane—and thus these are not to be seen in the photograph One of the other photographs which we reproduce, however, shows these floats as used at Hammondsport. The cylinders shown in this picture are somewhat larger than those that were actually used, which were about 7 inches in diameter and 7 feet in length In several of the photographs, showing the biplane in flight, these floats can be seen projecting from the back of the lower plane Together with the air inflated bag stretched along the lower runner, they had sufficient buoyancy to keep the machine from sinking should Mr Curtiss have been compelled to alight in the Hudson An examination of his machine showed that the oil tank had sprung a leak and had he not had an indicating gage constantly before him he would not have known that his supply was rapidly diminishing, and thus he might have had his motor seize

The Scientific American Trophy, the first prize ever offered for successful flights with heavier-than-air machines.



Curtiss

New York, May 24/10.

RECEIVED
MAY 25 1910
Ans'd

To Aero Club of America
39 W. 39-st., N. Y.

I hereby make official entry for the Scientific American Trophy, under the rules for 1910 It is my intention to start on a cross country flight from Albany, N. Y. on Thursday morning, May 26,1910

I will use a Curtiss aeroplane of the following description; weight 900 lbs.; surface area, 236 square feet; motor 50 H P. 8 cylinder, water cooled; longest time the machine has been operated in one flight 38 minutes.

If there are any fees connected with this entry, they will be paid on Wednesday, May 25.

Very truly yours,

Glenn H Curtiss
Hotel Astor, N.Y. City

Copy sent to the Scientific American, 361 Broadway, N. Y.

Mr. Curtiss's notice that he would compete for the Scientific American Trophy.

The biplane with which Mr Curtiss accomplished his epoch-making flight is very similar to the machine with which he won the Bennett Cup last fall at Rheims. It differs from the latter in having somewhat larger rudders and balancing planes, and also in the extension of the upper plane 30 inches beyond the lower plane at each end of the machine This differential plane idea was first tried a short time ago by Henry Farman, and was embodied in the machine used by Paulhan in his flight from London to Manchester It tends to give the aeroplane a certain amount of inherent transverse stability The total supporting surface in the main planes is 236 square feet, and the weight of the machine complete is 950 pounds including aviator fuel and oil As a result of this the weight carried per square foot of supporting surface is 4 02 pounds This means that the machine must travel at a speed of 40 miles an hour along the ground before it will lift In order to attain this speed, a powerful 8-cylinder motor of 50 horse-power is used The 7 foot diameter, 6 foot pitch propeller mounted upon the engine crankshaft makes 1,100 R P M while the machine is in flight, and gives a pull, when the machine is held stationary on the ground, of over 300 pounds This is, we believe somewhat better than the thrust obtained from the Gnome 50-horse-power motor used by Farman and others in their aeroplanes

The longest flight which Mr Curtiss had formerly made with his new biplane was a flight of 38 minutes duration above Lake Keuka at Hammondsport, N Y, in his try-outs of the machine The greatest care was taken in re-assembling the machine at Van Rensselaer Island, to see that all nuts were properly washered, cotter pinned, and covered with varnish, so that they would not work loose Some idea of the strains that must be undergone by a machine in flight can be had when one learns that Mr Curtiss's biplane was suddenly dropped 40 to 50 feet while in flight, by the downward current of air mentioned, and then quickly made to support itself again by a dive of considerably greater length One reason for the success that the Curtiss machine has met with is undoubtedly the neat and strong manner in which it is put together There are no bent struts and loose guy wires, such as we have noted in one of the well known foreign biplanes that was recently brought to this country, but everything is put together in a thoroughly workmanlike manner, and consequently there have been no accidents

In making his great flight, Mr Curtiss also competed for the SCIENTIFIC AMERICAN Trophy, which is to be awarded this year for the longest cross-country flight. The first record for 1910 therefore stands at 74¼ miles but it is probable that this will be lengthened considerably before the end of the year

The average speed made by Mr Curtiss from start to finish of his flight from Albany to Manhattan Island — a distance over the course followed of 128 miles—was 50½ miles an hour Including the final leg of 14½ miles from 207th Street and the Hudson River to Governor's Island (142½ miles) this average falls to 49 14 miles an hour The actual air line distance between the starting and finishing points is 136 34 miles, so that using this as a basis, the average speed from point to point was but 47 01 miles an hour, which is the same as Mr Curtiss averaged in the Bennett Cup race at Rheims. As he no doubt covered more than 136 1 3 miles, it seems his new machine is faster than the Rheims racer with which Hamilton is making flights at Mineola, L I

View of Curtiss machine showing pontoons to keep it afloat on water.

THE ALBANY-NEW YORK AEROPLANE FLIGHT.

An Aerial Torpedo.

By W. G. Aston

One of the most remarkable demonstrations of the possibilities of "wireless" has been made in London last month, when Mr. Thomas Raymond Phillips, a Liverpool engineer, conducted a series of experiments on a small scale with a dirigible balloon entirely manipulated and controlled from the earth. These tests were made at the Hippodrome, one of London's largest theaters. Mr. Phillips employed a dirigible on the lines of the "Zeppelin," but only 20 feet long. The model complete weighed about ten pounds, and the aerostat was filled with hydrogen.

During the demonstration the inventor stood on the stage of the theater while his machine maneuvered about over the auditorium. He had by his side a keyboard something like that of a typewriter but rather larger, and in reality composed of a number of push switches; above this was a small transmitter similar to that used in ordinary wireless telegraphy. By merely pressing the keys Mr. Phillips showed that he could make his dirigible do anything he liked. He would press a switch over and the machine would promptly rise; the actuation of another key would produce a descent. Forward and backward motion was also obtained with perfect certainty, as well as circular flights and point-to-point voyages which involved very intricate steering. The experiments lasted some hours, but never once did the model fail to do what the inventor had announced it was about to do. The most effective demonstration, however, was that in which the uses of such a machine in warfare were shown. The car of the dirigible had a trap door floor under the control of the operator, who, after maneuvering the machine over a certain spot, opened a switch which caused the trapdoor to open and allowed a number of paper bombs to fall down.

The mechanism of the invention is extremely simple and one that could be made perfectly reliable. In the car of the balloon are a number of coherers suited to different electric wave lengths, and these control small switches which put into and throw out of action two sets of propellers, the trapdoor, and the system of lamps whereby the airship can be lit up when desired. The accumulators for working the propellers and lighting the lamps are carried in the car. The directional control of the airship is effected in a horizontal plane by a pair of propellers hung out from each side of the car on outriggers similar to those of the "Zeppelin." Either or both of these can be driven, and they can also be reversed either singly or together, so that the machine can be steered to the right and to the left, kept in a straight course, or reversed back in its own tracks without turning round.

Two horizontal propellers considerably smaller than the driving screws are also attached by outriggers to the "nacelle," and provide the means for control in a vertical plane. The machine is so balanced as to be approximately equal in weight to the air it displaces; consequently, when the horizontal propellers are not working it neither rises nor falls, but can be made to ascend or descend by putting them in motion. Thus by using one vertical propeller and the horizontal ones the machine can be caused to move in a spiral path, and by cutting out the vertical screws it can be made to rise straight up.

The switches whereby the machine is controlled alter the wave length of the electricity produced at the transmitter, all the coherer switches on the airship being tuned to different wave lengths.

The demonstrations have been so successful that the British War Office have investigated the matter, and it is understood that they have taken the invention up. At any rate trials with a full sized machine are shortly to be made, and if these are successful the invention will be bought by the government. The dimensions of the full sized war machine will be 60 feet long and 6 feet in diameter, and it will be capable of carrying nearly a couple of hundredweight of explosives, while its radius of action will be well over 100 miles. Its speed will be about thirty miles per hour.

MR. EDWIN GOULD OFFERS $15,000 TO THE SUCCESSFUL DESIGNER AND DEMONSTRATOR OF A SAFE HEAVIER-THAN-AIR FLYING MACHINE EQUIPPED WITH MORE THAN ONE MOTOR AND MORE THAN ONE PROPELLER.

The fac-simile letter of Mr. Edwin Gould, printed on this page, in which $15,000 is offered for the best successful heavier-than-air flying machine, driven by more than one motor and one propeller, speaks for itself. It may be pointed out, however, that Mr. Gould, in offering his prize, has been moved by other considerations than those involved in a sporting contest. Races, long-distance flights, speed tests, and other record breaking performances, have no doubt done much to bring the flying machine prominently before the public, but it must be admitted that, besides whetting the natural human appetite for competition and driving home the truth that the flying machine is destined to play an important part in future human affairs, such contests aid the art but little.

It is Mr. Gould's primary intention to further aeronautic invention and with that end in view he offers a prize not for the fastest flying machine, but for a type of flying machine which has thus far not been constructed. Absolute safety must certainly be attained before a flying machine can ever become even a popular vehicle of pleasure, and the attainment of safety is the chief object which Mr. Gould has in view.

St. Louis Southwestern Railway Company,
Office of the President,
165 Broadway,
Edwin Gould, President.
New York June 2, 1910.

To the Editor,
The Scientific American,
New York City.

Dear Sir:-

In order to promote progress in aviation, I offer through the Scientific American, a prize of $15,000, which is to be given to the inventor who designs and demonstrates in this country the best heavier-than-air flying machine equipped with more than one propeller and with more than one independent motor, in such manner, that the motors can be operated together or independently.

My object in offering the prize is to encourage the invention of a heavier-than-air flying machine which will be able to continue in safety on its course, even though one of the driving devices should break down.

In order that the efficiency of the inventions may be thoroughly tested, it will be necessary to subject them to endurance tests of stipulated length of time or distance.

Full conditions governing the award of the prize will be announced in a later issue of the Scientific American.

Very truly yours,
Edwin Gould

MR. EDWIN GOULD'S OFFER OF A $15,000 AVIATION PRIZE

The conditions which will govern the novel contest which will be inaugurated by Mr. Gould's magnificent offer have not been decided upon as yet. They will require deliberation. It is hardly likely that we shall be able to publish them for three or four weeks. In the meanwhile, the Editor will gladly consider any suggestions which the readers of this journal may make so that conditions may be drawn which will be fair and which will best serve the object of the prize.

Kinetic energy is the power stored in a moving object which keeps it in motion. By way of illustration, conceive a railway train rushing along a straight, level stretch of track, the train being driven to its power limit. If the source of power, say the steam pressure, is now suddenly removed by closing the throttle, the train will continue to run or "coast," for a long distance, due to its kinetic energy, gradually reducing in speed until the energy is exhausted and the train stops.

Recent Study of the Sun.

The sun can be studied with comparative ease even by the possessors of small telescopes, consequently the announced discoveries are numerous; but astronomers are constantly placing their chief reliance on the statistical results of precise measurements and daily and long-continued observations, and they do not accept the physical theories advanced until after a long period of probation. Even data which have been admitted and used for many years are not exempt from criticism. Thus, the elements of the sun's rotation determined by Carrington fifty years ago, which are still used in the reduction of the photographs taken daily at the English observatories, have been called into question. Turner has examined the measurements made by Peters between 1860 and 1887, which fill the gap between Carrington's work and the Greenwich photographs. He reaches the surprising conclusion that the sun spots of the northern and southern hemispheres revolve about two different axes, which make with each other an angle of 6 minutes. The spots appear to be affected by a general drift which changed direction about 1885.

The hypothesis of a planetary influence on sun spots has been often discussed and generally rejected. In its favor, however, may be cited the proved fact that the last maximum in the number of spots which was announced for 1905, was delayed nearly two years, and that this retardation had been predicted by Brown as a consequence of the motions of Jupiter and Saturn.

The solar activity gradually decreased in 1909, as had been expected. Nevertheless, a group of spots remained visible from November, 1908 to April, 1909. The group which appeared in September 1908, was found to be connected with a violent magnetic storm. Lockyer's photographs made with the spectroheliograph, show that the principal spot was gradually obliterated by clouds of calcium which exhibited a cyclonic structure thirty hours before the maximum of magnetic disturbance. Mitchie Smith observed that an extraordinary outburst of activity in the same spot was quickly followed by violent and prolonged agitation of the magnetic needle. This group of spots affected the earth's magnetism in four successive revolutions, in two of which it produced two disturbances at intervals of five days. This fact suggests the influence of two limited and divergent beams analogous to the double tails of certain comets.

The tendency to recurrence at intervals of 27 or 28 days, is well established for magnetic storms and auroras. The question has been asked whether other terrestrial phenomena do not similarly show the influence of the sun's rotation. From the records of cyclones in the Indian Ocean, Maunder finds that an interval of 28 days is of common occurrence.

The first results of the total eclipse of 1908 have been published. The report of MacClean's expedition say that the corona exhibited the character, usual at intermediate epochs, of great extent in the middle latitudes, but that it was distinguished by certain features from all previously observed coronas. The coronal rays or streamers showed no connection with the protuberances.

The United States during February produced pig iron at a rate which equaled 31,650,000 gross tons per annum. During January the rate was about 31,-000,000 tons, and in December about 31,450,000 tons. In commenting on these figures, the Iron Age considers it is questionable whether the February rate will be maintained during March, since the daily capacity of coke and anthracite furnaces in use at the beginning of the month was 84,854 tons, whereas the daily rate of production for February was 86,616 tons. "It is hard to realize," the journal remarks, "that in February the production was more than 40 per cent above that of February of last year, and nearly 2 1/3 times that of February two years ago, and yet that so little metal is pressing on the market. . . . It is not surprising that a question is raised of the ability of the country to absorb pig iron at the present rate throughout the year."

DR. ROBERT KOCH, THE FATHER OF PREVENTIVE MEDICINE

BY JOHN B. HUBER, A. M., M. D.

Dr Robert Koch died on May 27th last. To estimate the value of his work, we must consider how humanity suffered from disease before his time

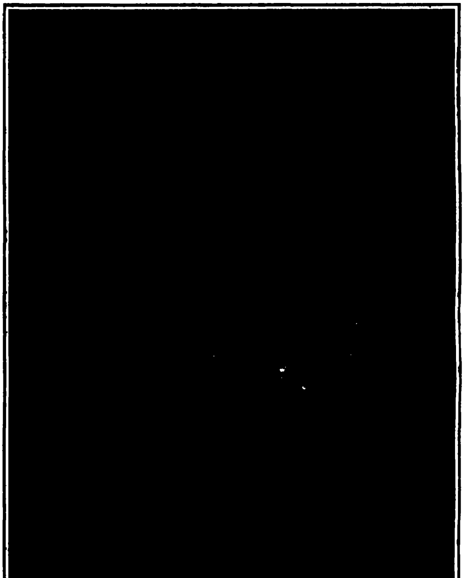
Before the beneficent inoculations of Jenner, epidemics of smallpox devastated vast regions, decimating cities and wiping out whole towns and villages. Nearly every wayfarer one met was a pock-marked survivor The dreadful history of the bubonic plague is lost in the mists of antiquity To go no further back—an epidemic of it was the last of those seven plagues that afflicted Egypt. Those 50,000 Israelites and Philistines at Beth-Shemesh, and those 70,000 others were destroyed by the microscopic *Bacillus pestis* Before and since the Trojan war (in which this germ did its greatest execution), throughout the middle ages, and indeed up to our time, scores of epidemics of the bubonic plague have wrought ghastly havoc One of these, the Black Death of the fourteenth century, destroyed most miserably (so Gibbon computed) one-fourth the population of the then known world

Malaria, though not so death-dealing an agency, has nevertheless dreadfully affected the *morale* of humankind To cite but the one historic instance given by W H I Jones of Cambridge As is so often the case in history, the conquering Greeks under Alexander were conquered by the India they invaded, and its weapon was one much more potent than the sword—it was the microscopic malaria plasmodium Upon its inroads the Greeks began to "lose much of their intellectual vigor and manly strength"

Consider finally tuberculosis — consumption — which has probably always afflicted mankind At any rate Hippocrates twenty two centuries ago, wrote of it as the disease which above all others caused the most suffering and the greatest number of deaths The dreadful infections here mentioned, though more gruesomely picturesque in their ravages, have been dwarfed by consumption In the nineteenth century fourteen millions died in war, by bullet and steel and camp diseases, during the same period thirty millions succumbed to consumption From time immemorial every third or fourth adult—in some communities every other adult—has succumbed to insidious phthisis We whites have introduced this disease among negro "brethren," who die of it in greater numbers than we do, and among our Indian "wards" who are fast disappearing by reason of our tuberculosis, aided and abetted by our "fire water" Who has not, either in his family or among his friends, had to endure some experience of the "Great White Plague"? Think of it! Between adolescence and the fifty-fifth year, in those years when young men and young women contemplate marriage, when wives should be strong to rear their children, when husbands should be strong to maintain their homes, when we should be strong to do the world's work, in those most precious years tuberculosis has throughout the centuries been claiming every third or fourth of our race Consider how often the wage earner has first succumbed; and how, through the many months and the years of this chronic disease, his family must endure the privations imposed by it, and oftentimes in turn themselves become its victims. The world, moreover, has lost treasures immeasurable by reason of the untimely sacrifice of men and women of genius to tuberculosis, "death's direct door to most hard students, divines, physicians, philosophers, deep lovers, zealots to religion." Tuberculosis has ever been at least as great a devastating social and economic factor as it had been a death dealing infection, every year our nation alone has been sustaining by reason of it a monetary loss of more than a thousand millions of dollars.

Reflect upon all these things, and then turn the mind to the year of Koch's birth—1843 In that year Pasteur entered the university

And let us premise here that in science great names are landmarks, and the owners of these names have traversed and gleaned in the fields where many a devoted and now forgotten laborer has delved and sown and perhaps sweated blood It should indeed be a comfortable observation that in science at least no man works in vain Full many a one has given his whole life to establishing a fact, or indeed only an item to a fact, his industry unrecognized, ridicule and even persecution oftentimes his only compensation, living perhaps in the pitifulest destitution, yet his life and his works have been absolutely essential to the universal scheme There is the human unit, and there is the welfare and the very existence of the race, which latter were impossible without the self abnegating labors of the individual



DR. ROBERT KOCH

Nor does it in any wise detract from the gratitude due the great man, that he had profited by the labors of others, adding what he can of his own, scrutinizing every detailed datum in the whole fabric permeating and illuminating it with his own mind, and extracting from the mass the mighty deductions of genius. Thus did Jenner's inoculations, upon the principle of fighting fire with fire, make clear the way for Davaine and Lister and Pasteur, upon whose substructure Koch built. These latter developed the germ theory of disease, Koch made of this theory the science of bacteriology, which is to-day the most potent factor in civilization. Pasteur declared it to be within human power to banish all parasitic diseases from the face of the earth, Koch clearly demonstrated how this business was to be gone about.

When Koch was seventeen he persuaded his father to get him a microscope Possessed of this most congenial companion, he set about perfecting other technical means of investigation For even genius cannot work effectively without good tools After attaining his doctorate in medicine he became a simple country doctor, utilizing the time which—mournful to relate—every beginner in practice has a plenty, in scientific study experimentation research, and writing In those years he laid all the foundation of his future greatness. At that time he was not enrolled in any world-famous institution, nor had he millions at his back Such aids to success are not to be decried, yet it is amazing how frequently genius, burning unquenchably in the service of humankind has managed to get along without them, how they never avail at all in the absence of the right man.

But soon the German government became cognizant of Koch's writings. That government recognizes good work; it avails itself of ability, it engaged Koch in its service

It 1882 came his truly epochal discovery of the tubercle bacillus, the essential cause of tuberculosis Here was laid down the sure and scientific basis of the anti tuberculosis propaganda which has since been so successfully waging Upon this foundation were preventive measures intelligently formulated and with wonderful result up to our day In Prussia (Koch's own country) the consumption mortality has been reduced forty per cent, in Boston, forty five per cent, in New York city fifty per cent In our northern cities twenty per cent in the years of 1901-6 And it is being confidently predicted on the basis of the prophylaxis thus far achieved that our children—yes, even we in this generation—may see this dreadful scourge of the centuries all but eliminated from human experience Koch elaborated various tuberculins diagnostic of tuberculosis, their curative properties have unfortunately proved disappointing yet they were the basis of the wonderfully effective antitoxins of diphtheria, tetanus (the most agonizing of all diseases of which formerly nearly all the sufferers died) meningitis pneumonia, and other dreadful infections

And Koch's achievements in tuberculosis were only a part of his service to mankind In 1881 he discovered the cholera bacillus which is responsible for that disease In the investigation of other world scourges—cancer bubonic plague septicæmia (blood poisoning), trypanosomiasis cattle plague, anthrax malaria—Koch's part has been most vital, either as discoverer or as originator or developer of prophylaxis and curative methods

He showed how malaria could be absolutely vanquished by stamping it out of the island of Brien in the Adriatic, under commission of the Austrian government In Bombay he studied the bubonic plague at first hand When long past threescore he repaired to a desolate island in Victoria, Nyanza his only white companion being an army surgeon and throughout the whole of eighteen months they together saw but three other whites A rough canoe, hewn out of a single log, was their only means of communication with the mainland There Koch discovered the crocodile's blood to form the chief nourishment of the tsetse fly, the blood-sucking insect that transfers the

(Concluded on page 490)

The Collection and Preservation of Moths and Butterflies

BY FREDERICK M. SCHWERD

The most beautiful members of that very large zoological class termed insects are butterflies and moths. Because of their beauty they have always received more or less attention from collectors young and old. Many have started to gather these insects, but because of lack of the knowledge of how to preserve them their so-called collections have spoiled, and the specimens have become broken and moth-eaten. In the following words I shall endeavor to describe, without the use of scientific terms, a method in which to preserve their captures, and which gives such pleasing results that the finished labor will be a source of enjoyment both to the collector and his friends.

The specimens must be caught before being preserved; therefore, it will be most convenient to begin with a description of the primary requisite for this work.

The Net.—The frame or rim of the net is easily made from a piece of iron or telegraph wire about forty-two inches long. This wire is bent in the form of a loop, leaving two straight ends, each about four inches long, in the manner shown in the illustration 1. Some sort of rod must then be secured, to serve as a handle. A broom handle answers this purpose very well, but a rod about an inch in diameter and five feet long can be procured at any lumber yard for a few cents. Through this rod about half an inch from the top a hole is drilled, as shown in Fig. 2. The straight ends of the wire are pushed through this hole, one from either side. The projecting ends are fastened against the handle with staples or wire wound around. (See Figs. 3, 4, and 5.) Only the making of the bag remains. For this purpose tarletan or other fine netting of a brown or green color should be used. Mosquito netting is rather coarse and should not be used, as it scratches the wings of the insects. The bag should be about twenty inches deep and the bottom rounded as in Fig. 6. It may then be attached to the rim by means of tape.

How to Kill the Insect.—When the insect is fluttering in the net, the question arises how to kill it painlessly and quickly. This may be accomplished in several ways. Most collectors use a cyanide bottle, which is prepared in the following manner. Into a wide-mouthed glass are placed a few lumps of cyanide of potassium. Upon these is poured plaster of Paris to the depth of one inch. When the plaster is dry the bottle is tightly corked, and must not be left uncorked. The body of the insect is gently held between the thumb and index finger (7) and a drop of chloroform is dropped upon its head from a vial carried in the pocket. The insect immediately stops its fluttering and may then be taken from the net and placed

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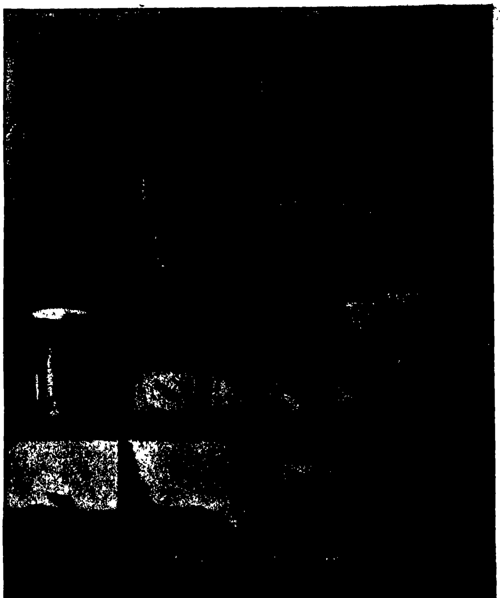

1, 2, 3, 4, 5, and 6 show the details of net and frame. 7. Chloroforming an insect. 8. Medicine dipper. 9. Glass for holding dying insect. 10. Envelope for preserving dead insects. 11. Pushing pin through a specimen. 12. Bending wings into horizontal position. 13. Pinning insect to a board. 14. Insect between glass pieces before mounting. 15. Insect mount, showing glass shelf.

COLLECTION AND PRESERVATION OF MOTHS AND BUTTERFLIES.

BERTILLON AND THE BURGLAR'S "JIMMY"

BY JACQUES BOYER

The police officer or magistrate engaged in the elucidation of a crime, endeavors to collect as many exact facts as possible and the more methodically he seeks verifies and gives a logical grouping to his evidence, the greater is his chance of discovering the true cause and the perpetrator of the crime.

M. Bertillon, the celebrated chief of the anthropometric service of the French police, has recently invented a dynamometer of special character, which will facilitate judicial investigations by furnishing exact measurements of the muscular efforts which are manifested in the violent entry into a house, room, or desk, and by making it possible to reproduce the traces of his work which the burglar has left on doors and articles of furniture. The apparatus consists of a steel frame, which is attached by screws to a wooden table. It contains a lower plate which can move forward and back, two lateral uprights stiffened by curved braces, and a cross piece of steel attached by strong bolts to the tops of these posts. This frame carries

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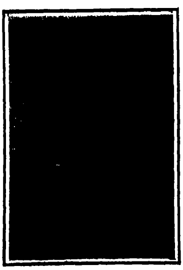
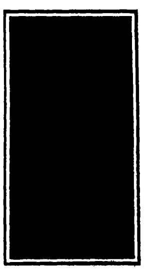
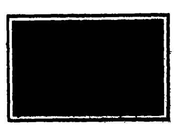
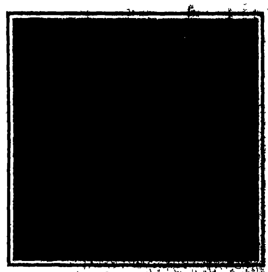


The Bertillon effraction dynamometer—a mechanical detective.





Impressions of the three fundamental types, showing the force in kilogrammes required to produce each.



The Bertillon effraction dynamometer which records force required to [illegible]

A MECHANICAL BURGLAR DETECTOR.

GAS WATER HEATER FOR KITCHEN BOILERS.

BY JOHN A. BERGSTROM.

One of the chief drawbacks of the gas kitchen range is the problem of maintaining a suitable hot water supply. A small heater attached to the kitchen boiler will overcome this trouble. The accompanying illustrations show how such a heater can easily be made and connected at a very small expense It will only take a few minutes to heat enough water for a bath or for washing dishes or clothes. As the hot water rises and stays at the top of the boiler until drawn off at the faucet it is not necessary to heat all the water in the boiler, as is the case when it is connected with the kitchen range in the usual way, but only such amount as may be required for the time being The heater as illustrated in the vertical section, Fig 2, and cross section, Fig. 3, consists of a copper coil, inclosed in a casing, with a gas burner in the center of the coil, and it is connected to the kitchen boiler at the top and bottom. The gas burner can be made with or without a primer or lighter It can also be connected with a self-lighter to be operated with a push button in the usual way

Take an ordinary tinned copper tube about one inch in diameter, and fill it with fine sand, closing the ends with stoppers. With a wooden mallet begin about 3 inches from each end to flatten the pipe, until it is ¼ inch in thickness. After this, make a wooden center, say 6 inches in diameter, with one end tapering or rather rounded off. One end of the tube is now fastened to this wooden center and the flat pipe is wound around the same, forming a close helix. The other end is then formed over the tapering end of the wooden center by hammering it into place with the mallet, until the coils begin to close up, leaving enough space for the spent gases to pass out The end must of course be made straight and in the center so that it will enter the central hole in the casing or cover which is to be connected to the boiler

After the coil is made into the required shape, the stoppers in the ends are removed, and the sand made to run out by turning the coil around and tapping it lightly with the mallet. It may then be connected to a faucet and washed out with water The lower end of the coil may be bent at any angle to suit local conditions

The externally threaded end of an ordinary ¾-inch union is now slipped over the end of the coil which is peened over, say about 3/16 inch, forming a flange which serves to connect the copper tube and iron pipe with the ordinary union. (See Fig. 4.). This should be done at each end of the coil. Of course the heads of the casing should be put on before the unions are fastened to the coil. The coil is now inclosed in a sheet iron casing (a piece of 6-inch stove pipe) with a layer of asbestos between the coil and casing.

The top of the casing is connected to the chimney or the atmosphere with a small pipe, to carry off the burnt gases. If connected with the outside atmosphere, a suitable cap or hood should be provided at the outlet and so that the wind will not blow through it, extinguishing the fire.

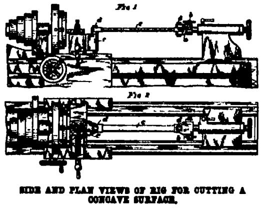
The burner is made out of an ordinary nipple, with caps on each end. In the nipple are drilled a number of small holes. Inside the nipple is a small iron cylinder with conical bottom, and provided with a small flange at its upper end, where it is fastened between the end of the nipple and the cap The object of this cylinder is to partly fill up the inside of the nipple, leaving a small annular space for the gas and air to pass up and out through the small holes in the nipple. To the lower head of the casing is fastened an ordinary air regulator, into which the gas pipe is secured, forming an ordinary Bunsen burner

The main feature of this heater is to introduce the water in a very thin, circular sheet surrounding the central heater It will now be seen that when the gas is lighted the water in the flat coil becomes hot and starts to circulate around the fire up the spiral course to the top of the boiler The temperature of the water may be regulated by inserting a valve below the coil, but for ordinary use this is not necessary

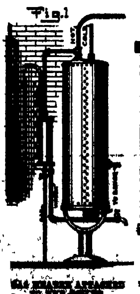
Fig 1 shows the complete heater connected up to a kitchen boiler with a vent pipe for the spent gases connected to the chimney

Fig. 5 shows how the heater may be fitted up with a primer, or starter for the gas, which is merely a small independent Bunsen burner, connected below the regular mixing tube This burner is first lighted, the flame will shoot up into the heater, the ordinary gas-cock is then turned on and the gas ignited, when the primer may be turned off. This is only a matter of convenience in starting the big burner, as a match or a taper will do the same thing

Fig 6 shows a system in which the heater proper is located in the basement and the supply pipe, instead of being connected to the boiler or storage tank, is controlled independently from each floor The heater is equipped with an electric self-lighting apparatus, such as may be purchased in the market. An ordinary "off and on" push button is placed at each floor, near, or it may be connected to the water faucet The apparatus is quite simple, it is only necessary to push a button, which will ignite the gas in the heater, and then open the faucet. The cold water in the pipe will run out, of course, before the hot water makes its appearance The temperature of the water can be regulated by the faucet That is to say, the greater the heat desired, the smaller should be the quantity allowed to run through the faucet, and *vice versa* When no more hot water is wanted the other button is pushed, which cuts off the gas and puts out the fire in the heater, and the faucet is closed This operation may be repeated any time hot water is wanted. If cold water is wanted, it is only necessary to turn on the faucet, without starting the fire Thus hot or cold water may be drawn from the same faucet at will.

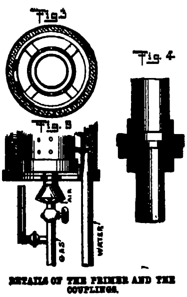


SIDE AND PLAN VIEWS OF RIG FOR CUTTING A CONCAVE SURFACE.

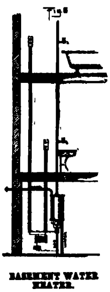


GAS HEATER ATTACHED TO THE BOILER.

VERTICAL SECTION OF THE GAS HEATER.



DETAILS OF THE PRIMER AND THE COUPLINGS.



BASEMENT WATER HEATER.

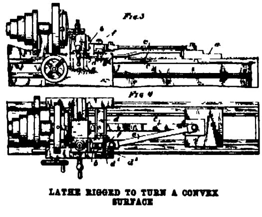
TURNING CONCAVE AND CONVEX SURFACES.

BY E. B. UTERSTADT

Some time ago the writer had occasion to make a pair of laps for grinding telescope lenses, and as this calls for very accurate work in order to get a true curve, it became necessary to make the attachments which are here described In this class of work it is imperative that the utmost care be given the construction of the several parts, as upon the accuracy of the measurements and nicety of fit depend the quality of the finished product There must be no lost motion anywhere, as this would mean chatter marks on the surface of the work. For this reason it is better to use taper pins or bolts as these will insure a close fitting joint, and the extra trouble will be more than repaid The rigidity of the radius bar is of vital importance, it is far better to have it too heavy than too light. Nothing is better than a good cast iron bar, for it is less apt to spring than steel For radii of 15 to 24 inches, a bar ⅝ by 1½ inch cross-section is none too heavy, while for radii of 24 to 36 inches ¾ by 2 inches is of about the proper proportion

Figs 1 and 2 show front and plan views respectively of the concave attachment The radius block *a* is bored to make a close fit on the nose of the tail-stock spindle, and is provided with a tightening screw *b* for binding the block securely in place It will be observed that the block is split where the tightening screw works The lugs or ears which receive the radius bar *c* are now finished on the inside, and the holes for the pin or bolt *d* are drilled Care should be used to get these holes directly in line with the dead center, it may appear that a slight variation one way or the other may be of no account, but it is A good mechanic always adheres to the rule "Anything worth doing at all is worth doing well The block *C* is secured in any suitable manner to the tool post slide As this part of various makes of lathes differs it is impossible to give a form of block to fit all but any good mechanic can devise means for securing one to his lathe Regarding the radius bar *c* little can be said except the spacing of the holes On the accuracy of this depends wholly the accuracy of the curve of the part machined Fig 2 shows the tool on a line with the center, in which position it is set before starting to cut. The tail stock is now clamped in position, while the lathe carriage should be free to move back and forth on the ways As the tool post slide is drawn toward the operator the carriage will be drawn back, causing the cutting tool to describe an arc the radius of which is equal to the distance between the centers of the holes in the radius bar The tool is fed to the work by turning the hand wheel of the tail stock screw while the cross feed is accomplished in the usual manner

Figs 3 and 4 represent the device for turning convex surfaces, which is somewhat more complicated than the mechanism described above The radius bar used for concave work can be used here but all of the other parts must be made especially for the purpose The block *a* must be planed and fitted to the inner ways of the lathe and mounted in such a manner that it can move freely backward and forward The slide *d* which carries the cross-slide block *d'* is securely bolted to the lathe bed Bolted to the sliding block *d'* is the bearing *d''* to which is secured the forward end of radius bar *c* On the upper side of block *d'* is a roller which runs in the slot in block *b* the latter being secured to the tool post carriage The lathe carriage and block *a* are rigidly connected by means of the bar *c*, the front end of which may be bolted to the bridge webs as shown by the dotted lines. The operation is as follows, bearing in mind that slide *d* is rigidly secured to the bed As the tool post slide or cross slide is fed forward, the sliding block *d'* is carried with it by means of the slotted block *b* and roller *f* As sliding block *d'* advances carrying with it the forward end of radius bar *c*, it becomes apparent that block *a* must move backward, and as this block and lathe carriage are rigidly connected by bar *c* the lathe carriage will be carried with it, the result being that the tool is caused to move in a reversed arc. It might be well



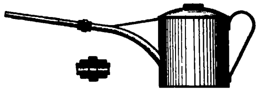
LATHE RIGGED TO TURN A CONVEX SURFACE

to state that in order to avoid resetting, it is a good plan to have the blank which is to be machined cast with a convex face of about the same curve as it should be when finished If this is not done or we wish to use flat disks of cold-rolled steel or other metal, it will be necessary to move the cutting tool forward after each cut

A SAFETY OIL CAN

BY A. J. JARMAN

When oiling electrical machinery, it is always advisable to safeguard yourself against accidental shock, especially when currents of high tension are being



OIL CAN WITH INSULATED TIP

generated It frequently happens when an ordinary long-spout can is employed for oiling dynamos that a severe shock is received by the oiler, resulting sometimes in death Several years ago the writer invented an oil can that was perfectly safe under all ordinary conditions of use Owing to the extreme simplicity of the design any one possessing ordinary mechanical ability can convert an ordinary oiler either of the vertical or horizontal kind, into a safety oiler Cut the spout in the middle and solder upon each end a piece of brass tubing having either an external or internal thread cut Fit thereon a coupling sleeve made of insulating material as shown in the sectional view The insulator can be made out of either hard rubber or vulcanized fiber turned in the lathe, with a milled center to admit of a firm grip when screwing or unscrewing the parts. Since oil is an insulator, no current can get past the coupling sleeve to the oiler's hand

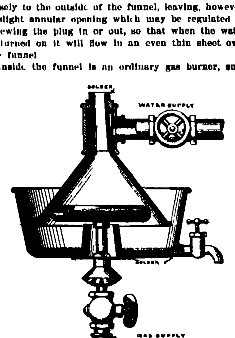
INSTANTANEOUS WATER HEATER.

BY GEORGE M. PAGE.

The old proverb, 'A watched kettle never boils," does not apply to the water heater shown in the accompanying illustration because hot or even boiling water can be drawn from it the instant it is put into operation It is made from an ordinary copper funnel and a cake tin

The copper funnel should preferably be tinned on the outside To the water supply pipe is attached a valve for the regulation of the flow of water To this valve is fitted a short nipple and an ordinary tee fitting One end of the arm of the tee is fitted with an ordinary plug which is bored and reamed out to fit the small end of the funnel and the end of same is turned over with a small hammer and soldered to the plug The other end of the tee is filed to fit very closely to the outside of the funnel, leaving, however, a slight annular opening which may be regulated by screwing the plug in or out, so that when the water is turned on it will flow in an even thin sheet over the funnel

Inside the funnel is an ordinary gas burner, such



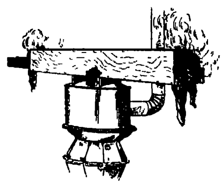
HOME-MADE INSTANTANEOUS WATER HEATER.

as may be purchased for ten cents This burner is connected to the gas supply in the usual manner It will be noticed by referring to the illustration that the funnel is in an inverted position The lower part of the funnel is surrounded by an ordinary cake mold, with the inside cone partly cut off This tin forms a basin for the hot water which may be drawn off with an ordinary faucet soldered to the cake tin, or it may be run off as the water heats. It will now be seen that when the gas is lighted the funnel becomes hot at once, and when the water is turned on it is forced through the narrow opening between the tee and the funnel in a uniform thin sheet which spreads over the funnel and becomes hot as it flows down. Almost any degree of heat may be obtained by regulating the flow of water with the valve. The spent gases from the gas burner pass up through the funnel and out to the atmosphere. Some arrangement may be made to connect the water and gas valves so that they will be turned on simultaneously, thus obviating the danger of overheating the funnel

STEAM BOXES FOR BOAT BUILDING.

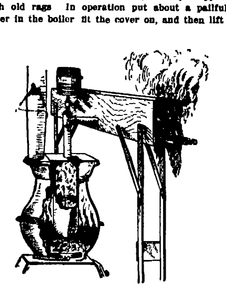
BY A. F. BISHOP

A simple method of rigging a steam box for boat work is as follows Take a common wash boiler, put a 1¼ inch hole in the cover to receive a short piece of tubing 2 or 3 inches long, which should be soldered. The steam box is made of wood, of any length desired, and about 10 inches high by 8 inches wide inside Make a couple of chocks hollowed out to fit the top of boiler cover, and nail them to the box Cut a round



STEAM BOX CONNECTED TO A WASH BOILER.

hole in the bottom of the box to receive the tubing that has been placed in the cover of the boiler Be careful not to allow the tubing to project inside the box The ends of the box are generally stopped up with old rags In operation put about a pailful of water in the boiler fit the cover on, and then lift the



STEAM BOX CONNECTED TO A CAST-IRON MUFFLER.

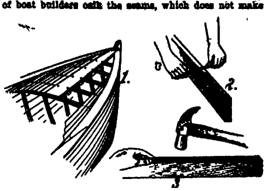
steam box and place it on top of the cover, allowing the tubing to enter the bottom of the box

Another method of constructing a steam box has been devised by William Ells, a boat builder It is made by taking a cast iron muffler, plugging the lower end, and connecting a short length of 1¼ inch pipe to the opposite end A tee is put on the end of the pipe with a short piece of 1¼ inch pipe screwed into the tee at right angles to the muffler piece. The upper end of the tee is plugged up with a wooden plug, if there is no reducer handy

Bore a hole in the wooden plug, and screw into it a short piece of ¼ inch pipe, fitted with a stop cock of some sort Above the stop cock, place a can or wooden paint pail, which is quite easily attached by simply boring a hole in the bottom and screwing to the short nipple above the stop cock In operation, the muffler is placed in the stove with a coal or wood fire A piece of sheet iron with a hole through which the pipe projects, serves as a cover for the stove. Water is poured into the paint pail and allowed to run down into the muffler as desired. A wooden steam box mounted on legs is connected to the muffler by the 1¼ inch pipe This style of boiler is not injured if it boils dry, and is frequently red hot when the water is put in This, of course, makes it "flashy," but otherwise no harm is done, as the pipe is of sufficient size to handle all the steam that is generated.

MAKING TIGHT JOINTS IN BOAT DECKS.

A boat deck is more exposed to severe attacks of the elements than any other part of the boat. The hot sunshine may be drying it up half the time, while during the other half, it may be covered with rain, dew, or salt water. And on this account the majority of boat builders calk the seams, which does not make



MAKING TIGHT JOINTS IN BOAT DECKS.

as pretty a deck as a tight seam, made in the following manner

Have the wood thoroughly seasoned and make a nice fitting joint for the deck plank that you are laying next to the plank sheer When this is done, take the piece out and with a smooth steel rod or burnisher of some kind, burnish down, with quite a pressure, the corner of the jointed edge, as in Fig. 2 of the accompanying drawing. This of course compresses the wood Now plane the wood down on the jointed edge, making a true corner again This is now ready to fasten on the deck carlins Proceed in like manner with the rest of the deck planks. The joints on a wooden tank or vat can be made tight by the same principle Instead of burnishing the corner a round rod is laid in the center of the jointed piece and with a hammer is forced nearly half its diameter in the wood (See Fig 3) This is planed down until there is no groove left, each joint is treated in the same way When the wood is moistened, the part that has been compressed by the round rod will expand This produces a very tight joint.

TO PREVENT OBSTRUCTION OF THE FEED PIPE IN AUTOMOBILES.

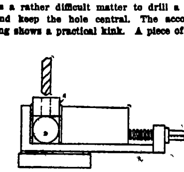
BY F. J. WATSON

Among the worst and most costly troubles of the amateur motorist are those connected with the piston, and if he is unable to discover the cause of the disorder he may have to pay heavily for curing that which could be avoided by observing the following simple precaution

Recently when my engine failed to work properly I determined to look into the matter myself, and started by removing the cylinder heads I discovered small particles of metal around the edge of the cylinders and the cylinders themselves were scratched up Tracing this to its cause I discovered that the feed pipe was almost clogged up with small particles of corroded copper Going further, my gasoline tank showed signs of corrosion which I attribute to poor gasoline, containing considerable moisture thereby causing corrosion of the copper tank After giving my tank a thorough washing and scraping I had it electroplated inside with a coating of tin All particles of metal were removed from the cylinders, the feed pipe was cleaned out, and the parts were connected up I have been running my motor for the past eight months without the trouble recurring, and have saved myself the cost of a new tank

HOW TO DRILL A HOLE CENTRAL IN A BAR.

It is a rather difficult matter to drill a hole in a bar and keep the hole central. The accompanying drawing shows a practical kink. A piece of tool steel



METHOD OF DRILLING A HOLE CENTRAL IN A BAR.

A is caught in the lathe chuck, and is turned and bored so the hole will run true with the outside diameter The outside diameter is turned the exact size of bar *B*, which is to be drilled. The bar *B* is placed in a vise as shown, the drill jig *A* is placed on top of the job, and the vise is then tightened up. As the jig and the bar are of the same diameter, the vise will hold them both very rigidly while the bar is being bored.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

BRAIDED NECKTIE.—O. SCHMIDT and O. DICKHAUS, New York, N. Y. This tie is so braided that the neck-band portion will be substantially inelastic and of a close weave, permitting it to slide easily between the folds of a turn-down collar. The tying ends are formed integral with the neck-band and are of greater width and looser weave than the neck-band portion and the terminal portion of each tying end is of tubular form and turned back, so that the free edges are concealed within the bulb. There are the same number of threads the entire length, and means provide for ornamental design.

Electrical Devices.

BRACKET FOR TELEPHONE-RECEIVERS.—H P VOSS, New York, N Y. The object of the inventor is to provide an attachment for a telephone of the class which refers more particularly to desk telephones, which will enable the receiver to be adjusted to the ear so that it will be supported in the proper position, while leaving both of the hands free to write or to make memoranda of the conversation.

DENTAL FORCEPS.—E. C. LOMBARD, New York, N Y. The forceps are of that type commonly employed for the extraction of teeth, and the object of the invention is to so construct the forceps that a current of electricity may pass from one jaw of the forceps through the tooth or the gum to the other jaw of the forceps while the forceps are in use.

Of General Interest.

FENCE-POST AND ANCHORAGE BASE.—P T BAILEY, Newport, R I. An object of this improvement is to provide a base which may be made of thin cast metal or constructed from compressed sheet metal, the purpose being to provide a strong, light construction which may be cheaply manufactured. The various forms of blades and spikes together with the post, may be formed of thin castings of rolled sheet metal which can be pressed into the desired shape.

MUSICAL INSTRUMENT.—W H DEBBURAU, Haselhurst, Wis. The invention refers to gramophones. Means provide for connecting the stylus with the bridge of the violin and for supporting a violin on the casing of the gramophone. A stylus or needle is attached to a violin or a like instrument, and the latter is held suspended with the stylus in contact with a revolving record, so that the violin forms the sound reproducer and amplifier.

CONCRETE WALL CONSTRUCTION.—L. LAPERRONNERIE, New York, N Y. The aim in this case is to provide a concrete wall construction arranged to provide suitable furring strips for fastening door frames, base boards, picture moldings and the like securely in place on the wall, the said strips forming integral parts of the blocks of concrete or other plastic material.

SAFETY GUARD OR SUPPORT.—L. B MELIUS, New York, N Y. The invention pertains to guards for watches and the like, and the object is to provide a guard or support which is simple and durable in construction, exceedingly strong and arranged to hold an article such as a watch, garment or the like securely in position and against accidental detachment or forcible removal by unauthorized persons.

TOOTH-CROWN.—F SCHAEFER, Oakland, Cal. This invention relates to certain improvements in tooth crowns, and more particularly to certain improvements in the manufacture of the pattern or model in imitation of which the gold crown is cast. The tooth crown conforms perfectly to the tooth, as an annular band for fitting around the tooth, presents the desired contour and is all formed of a single casting.

Hardware and Tools.

BANK NOTE CUTTER.—H. K. HORN, Hanover, Pa. The purpose of this inventor is to provide a cutter with a plurality of blades, which will hold a sheet of notes in position to be cut when the handle is operated, the frame of the cutter being open so that the notes fall therethrough when cutting.

CIRCULAR-GLASS CUTTER.—W CHASE, JR., Indianapolis, Ind. Among the principal objects which this invention has in view are the provision of an implement which may be centrally located upon the surface of glass and there immovably held, and to provide a swinging arm pivotally mounted upon a fixed structure and hingedly secured thereto.

STAPLE.—H F MERRILL, Williston, N D. Among the principal objects of this improvement are to provide a device having two anchoring extensions adapted to be driven into wood to form the grooves extended laterally from the path of the insertion of the device, and to produce a fastening device which is economical in structure, and durable and efficient in operation.

WINDOW-BLIND HOLDER.—O. THOMASEN, New York, N. Y. This invention relates to mechanism for use in holding blinds and analogous structures, the more particular purpose being to enable the operator to secure the blind rigidly in an infinite number of definite positions, so that the [illegible] effect of the blind [illegible] readily [illegible] at will.

Heating and Lighting.

VAPOR BURNER.—A H. WAITE, El Paso, Ill. This invention is an improvement in vapor burners of the character disclosed in Letters Patent formerly granted to Mr Waite. The principal features are pipes which curve about at opposite sides of the perforated top of the evaporating burner and directly above the screen of this burner, each pipe having an open forward end turned downwardly at the front of the stove. These at their opposite ends are connected to a common pipe, which passes through an air duct, and discharges at the vaporizer.

HYDROCARBON BURNER.—B L. WORTHEN, Tucson, Ariz. The improvement is adapted to various purposes of the arts and one of the principal objects thereof is to provide a hydrocarbon burner in which crude oil associated or combined with air, steam or other aeriform fluid, is most economically and effectively utilized in the production of a flame developing the maximum of units of heat and of force possessing the maximum of intensity.

MOP-WRINGER.—S T ATKIN, Georgetown, Texas. This invention is an improvement in mop wringing devices for use on buckets or pails. The mop wringing attachment is designed for use with that class of mops wherein the ends of the mops are held in the holder and the mop is formed into a looped form which may be fitted over the wringing arm and then twisted to wring out the water. The wringing arm is located within the bucket, reducing the liability of overturning the bucket during the operation of wringing the mop.

Machines and Mechanical Devices.

DEVICE FOR AUTOMATICALLY DELIVERING ARTICLES.—N R STILES, 34 Leadenhall Street, London E C, England. This invention relates to devices for delivering articles automatically from a container and is specially applicable for the delivery of cigarettes and the like from a cigarette container. Devices of this character as hitherto proposed have been unreliable in practice usually on account of the faulty feeding means to the element which selects the articles to be presented.

BRICK-MOLDING MACHINE.—T YOUNG, Lakeland, Fla. The object of the inventor is to provide a machine in which the bricks may be molded, in which the bricks are readily accessible, and which will separate from the bricks with the least danger of breaking and crumbling. It relates to brick molding machines in which the material is forced into the mold by tamping, the bricks being then removed to be dried and baked.

ROTARY FAN OR PROPELLER.—H RUTHENBERG, 52 Königs Allee, Villen Colonie Grunewald, Berlin, Germany. The invention relates to improvements in rotary fans or propellers adapted to act upon the air and particularly to such air propellers as are used for propelling air ships or flying machines and which are actuated either by hand or mechanical means.

Prime Movers and Their Accessories.

GAS ENGINE VALVE TIMER.—T P HROMN, North Bend, Ore. In operation the engine which is preferably provided with a compressed air starting device and with the usual sparking device is started by the said compressed air device. To reverse the engine it is necessary to move the lever to the neutral position before it can be reversed. Means provide for operating the valve to open the exhaust at every revolution of the crank, this being necessary for the proper working of the engine when starting.

Railways and Their Accessories.

STATION INDICATOR.—C MESSING, New York, N Y. This invention pertains to a new and improved device to be used in street cars, railroad cars, subway trains and the like to indicate the various stations, stopping places or streets. An object is to provide a station indicator which may be used on any number of branch lines with means for changing from one branch to another, such means including prevention of overrunning the changing point.

Pertaining to Recreation.

GAME APPARATUS.—W A SULLIVAN, New York, N Y. This invention relates to a game apparatus, and has for its object to provide an apparatus having a member supporting a ball which is adapted to be moved laterly by a baseball bat in the hands of a player, there being means which is adapted to indicate the force of the blow as the bat is brought suddenly into contact with the ball.

Pertaining to Vehicles.

TIRE-CASE.—C A RUSSELL, New York, N Y. This improvement pertains to tire cases or covers such as used for enveloping automobile tires, or the tires of similar vehicles so that they will be protected from the weather. Such covers are used especially on extra or spare tires which are carried usually in an exposed position somewhere about the body of the vehicle.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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AND EACH BEARING THAT DATE

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Screen plate fastening means, Webb & Barnard 959 979
Screening mechanism, W W Wilson 959,671
Screw cutting stock and die F L. Harker 959 788
Screw machine G T Warwick 959,[illegible]
Screw mechanism feed L. C Bayles 959,911
Screws, adjusting means for feed Shampon & Donahue 959 810
Separating bowl device for assembling parts of a centrifugal F R Bailey 959 [illegible]
Separating process, electrostatic W G Swart 959 646
Sewing machine, W F Lautenschlager 959,948
Shade and roller, window Lowe & De Young 960,228
Shaft collars and the like safety connection for J H Kelly 959 7[illegible]
Sharpener razor blade G G Floyd 959 [illegible]
Shears, gage attachment for Cole & Wright 959 464
Sheet metal box G Klenk 959,554
Sheet metal cutting machine H Hill 960,614
Shipping case E. Walsh 959,[illegible]
Ships' hulls and the like, cleaner for W R. Macdonald 959 [illegible]
Shirt B. Rosen 959,611
Shirt, swimming W T Anderson 959,441
Shoe cleaner G Narance 959 [illegible]
Shoes, making A. H Prensel 959,234
Sign, J Staren 959 [illegible]
Sign, portable J Staren 959,[illegible]
Silk like effects, compound for producing L. Lilienfeld 960 100
Siphon, A C Mills 959,779
Skiving machine cutter guard, Alden & Reinhardt 959 [illegible]
Slag handling, D. T Croxton 959 720
Smelting, E. Dedolph 959,[illegible]
Smelting ores, A R. Dwight 959 484
Smoke bell support D F McCarthy 959 [illegible]
Smoke house V Molitor 959 [illegible]
Smoking pipe etc J L. Thomson 959 [illegible]
Snap hook G M Hubbard 959,744
Snap hook W A. Schleicher 960,041
Soaps Making hydrocarbon, I Vanden Broek 959 [illegible]
Soldering iron self heating H Koenig 959,947
Sole attachment shoe T J Aldridge 959 442
Sole slipper Bickford & Sweet 960,140
Soles, manufacture of boot and shoe C. R. Sanderson 960,202
Sounding apparatus, C S. Lena 959 [illegible]
Spark arrester K M Colquhoun 959 [illegible]
Spark plug holder, Holden & Hendershot 959,[illegible]
Specific gravity, obtaining, A. Sommer 959 [illegible]
Speed changing mechanism A A Pace 959,[illegible]
Spinning and twisting frames, lappet for J W Cook 959,[illegible]
Spring See vehicle spring
Spring trip, C C. Flambo 959,[illegible]
Square and bevel F. H. Powell 960,[illegible]
Stable composition containing hydrogen peroxid, M A. Oesterer 959,[illegible]
Stacker hay, W S. Tibody 959,[illegible]
Stacker, hay, Armitage & Stephens 959,[illegible]
Stake holder A. J Bostwick 959,915, 959,[illegible]
Stamping device, check, F G Lundeen 959,[illegible]
Stamping, marking, or numbering machine, F W Merrick 959,[illegible]
Steam generator, water tube, Rosenthal & Boyle 959,[illegible]
Steam trap, [illegible] 959,[illegible]
Steam trap, C. E. [illegible] 959,[illegible]
Steam trap attachment, R. J Films 959,[illegible]
Steering gear, [illegible] 959,[illegible]
[illegible] 959,[illegible]
[illegible] 959,[illegible]
[illegible] 959,[illegible]
[illegible] 959,[illegible]

[illegible]
Type casting machine O V Sigurdsson 960,[illegible]
Telephone [illegible] system, [illegible] 959,[illegible]
Telephone [illegible], H. Blumenthal 959,[illegible]
Telephone system, A. D. T. Libby 959,[illegible]
Telephone system, automatic, A. H. Dyson 959,[illegible]
Threshing machines, separating grate for, F. F. Landis 959,[illegible]
Ticket, railway, W. S. Parker 959,[illegible]
Tie. See rail tie.
Tire, automobile, H. S. Shafer 960,11[illegible]
Tire for vehicles, elastic J. S. McGlashan 959,[illegible]
Tire lifter, J. W. Brown 959,[illegible]
Tire protector, pneumatic, R. J. Morrison 959,[illegible]
Tire remover, P. C. Wiest 959,[illegible]
Tire, vehicle, J W. Carhart 959,[illegible]
Tire, vehicle, J. A. Wright 959,[illegible]
Tire, vehicle wheel, W Wischard 959,[illegible]
Tire, wheel, R. Dahl 959,[illegible]
Tobacco pipe, A. N. Malcomb 959,181
Tool driving mechanism, M W Jessler 959,[illegible]
Tool, combination, P. E. Peterson 960,108
Tool retainer for air, electric, or mechanically driven implements, M G Hilpert 959,[illegible]
Toy, J T Binford 959,[illegible]
Toy, F E Callahan 960,073
Toy or picture book, G. Tuck 959,[illegible]
Track sander, W. A. Pitt 959,[illegible]
Traction mechanism, vehicle J. L. Williams 960,[illegible]
Train signaling and brake releasing mechanism, H. H. Hunt 959,749
Transom holder, Cox & Peterson 959,[illegible]
Transplanter, A. C. Rumble 960,118
Trap rest, J W. Walter 959,[illegible]
Tray raiser, O. R. Adams 960,130
Tread, safety, J T Simpson 959,[illegible]
Trigger controller, R. A. Moore 959,18[illegible]
Trolley pole, C. R. Bradford 960,18[illegible]
Trolley wire suspension means, S. S. Berkley 960,065
Trousers, adjustable, A P Melvin 959,[illegible]
Trowel, J G Thatford 960,210
Truck, tongue, C. A. Poell 959,[illegible]
Tube cleaning tool, C. F. Overly 959,[illegible]
Tube joint, J Kenny 959,949
Tufting machine, W R. Buser 960,073
Tufting machines, button support for, W R. Buser 960,074
Tug, hame A L. Saddlemire 960,114
Turbine, combustion, S. Z. de Ferranti 960,160
Turbines, turbo pumps, etc manufacture of strip material suitable for the blades of, S. Z de Ferranti 960,161
Type casting machine O V Sigurdsson 960,[illegible]
Type, printing, H J Smith 959 [illegible]
Type setting apparatus, L K Johnson 960,006
Type writing machine W E. Barnard 959 444
Type writing machine, W J Barron 959 [illegible]
Type writing machine F A Young 959,[illegible]
Type writing machine paper finger, C Gabrielson 959,[illegible]
Type writing machine ribbon feeding mechanism, F Alexander 959,[illegible]
Type writing machine ribbon reversing mechanism, automatic, G M Kittmiller 959,945
Type writing machine tabulating device, F Alexander 959,[illegible]
Umbrella, A Peck 960,068
Umbrella, folding Peterson & Callaway 959,[illegible]
Umbrella holder lock, Wilson & Harman 960,121
Umbrella runner G F Hall 959 169
Urn, reliquary, Wrinkle & Paddock 959,[illegible]
Vacuum cleaner, Foster & Glidden 959 720
Valve, S. E McKaight 959,794
Valve and the like stop J Fletcher 959,729
Valve, doubly actuated expansion, G P Carroll 959,[illegible]
Valve electric, F N Roebrich 959,[illegible]
Valve, electric, L. M Schmidt 959,618
Valve engine, Anderson & Hanson 959,[illegible]
Valve, engineer's, W A. Dendry 959 798, 959 799 959,802
Valve for charge forming devices, auxiliary air, J. H. Friedenwald 960,064
Valve operating mechanism J T Knott 959,788
Valve, retaining F H Woods 960,[illegible]
Valve seat grinder E. E. Townsend 959,[illegible]
Valve, triple W A Pendry 959,800, 959,801
Vehicle electric driving mechanism, A Aichele 960,140
Vehicle hood motor, W P Mays 959,[illegible]
Vehicle motor, E. Gerber 959,[illegible]
Vehicle spring H W Smith 959,[illegible]
Vehicle spring A M. Kindwall 960,178
Vehicle suspension, road, F Walton 959,[illegible]
Vehicle wheel A. Brisbane 959,705 to 959,707
Velocipede R. V Turner 959,[illegible]
Vending machine P S. Bloch 959,449
Vending machine, H S. Pond 959,[illegible]
Vending machine, card, R F Downey 959 [illegible]
Vise miter clamp, H. R. Depworth 960,[illegible]
Voting machine, G Johnson 960,[illegible]
Voting machine, J. McTammany 960,024
Wagon body, F F Groff 959 [illegible]
Wagon, dump, W R. Coates 959,[illegible]
Wagon rack adjustable, J W. Brown 959,[illegible]
Wagon reach adjuster, W F. Dunlap 959 [illegible]
Wagon, tank, W & A M Graver 959,[illegible]
Wall tie L. H Selden 959,[illegible]
Warp drying machine sized, G Maxwell 959,870
Washer See dish washer
Washing machine, J. F & W. P Burkholder 959,[illegible]
Watch stem movement, G W Grisdale, Jr 959,[illegible]
Water heater, T A Stiller 959,[illegible]
Water heater, automatic, A R. Miller 959,[illegible]
Water motor H. T Farnsworth 959 [illegible]
Wave receiving device, F G Sargent 959,[illegible]
Wedge, handle fastening, T Hooker 959,[illegible]
Weeder, H H. Cox 959,[illegible]
Weighing machine, automatic, H Richardson 959,[illegible]
Wheel cutting machine M Pederson 959,[illegible]
Wheel rim, vehicle, W R. Greer 959,[illegible]
Whip label guard, H. F Alston 959,[illegible]
Whip socket lock, G. Gobel 959,[illegible]
Willow stripping machine, G. S. & G. F Horwich 959,[illegible]
Window, [illegible] 959,[illegible]
Window screen, H. [illegible] 959,[illegible]
Wire drawing machine and annealing appliance therefor, J. A. Horton 959,[illegible]
Wire fastener, J. Lytle 959,[illegible]
Wire stretcher, R. R. Dobb 959,[illegible]
Wire twisting machine, J. F. [illegible] 959,[illegible]
Wood bending machine, J. E. Cameron 959,[illegible]
Wood, extracting products from, F. Pope 959,[illegible]
Wood, treating, J. [illegible] 959,[illegible]
Woodworking machine, A. E. Morris 959,[illegible]
Working apparatus, [illegible] 959,[illegible]
Wrench, F. [illegible] 959,[illegible]

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

[illegible]

THE MUSEUM AT MONACO.

(Concluded from page 476.)

left contain everything relating to physical oceanography, that is, the physical investigation of the sea, comprising all kinds of instruments, such as sounding devices with samples of the sea bottom, bottles intended for taking water samples and recording the temperature at a given depth, apparatus for investigating sea currents and the density of sea water, instruments for studying the penetration of light into the depth of the ocean, laboratory installations for the physical and chemical analysis of sea water and sediments, a collection of elements contained in sea water, etc.

All these variegated exhibits have been provided with labels in the three principal languages (French, English, and German) which greatly add to their utility and enhance their international character.

The first story, which is situated at 64 meters above the sea, likewise contains a large hall, in the center of which is exhibited one of the Prince's whale-boats with the whole of its equipment. On the walls are arranged six comprehensive collections of photographs relating to the voyages of discovery organized by the Prince, and all kinds of other oceanographic subjects. To the right of the entrance door is located a switch board for the electric lighting. The two halls adjoining the central hall are likewise taken up by glass cases containing a large variety of exhibits. The eastern hall, which is eventually to contain everything connected with the chemical and physical investigation of the ocean, and part of the sounding and fishing instruments, is taken up provisionally by divers subjects, especially those connected with marine industries, such as the sponge industry—represented by specimens of different stages of manufacture and different origins (especially Tunis)—the industry of coral (in the shape of raw materials and finished products of different origins, especially Japan), as well as the industries of mother-of-pearl, shells, pearls, salt, [illegible], whale oil, fish oil and skin, [illegible]. All the objects [illegible] supplied by the sea are on exhibit either in a fresh condition or as preserve; and even such materials as fish oil, guano meal, etc., are represented.

Another subject of great interest, and which will have to be further developed, comprises all kinds of fishing instruments (boats, nets, etc.), either in the natural size or in the shape of diminutive models. Many scientists and the Prince himself have designed special mechanical catching outfits for deep-sea fishing, while other instruments had to be constructed for gathering the microscopical plankton of the surface, intermediary zones and sea bottom, as well as for catching ocean animals of especially large size. All these manifold utensils are indispensable for obtaining an adequate knowledge of the customs, life, and evolution of those mysterious animals, and apart from their scientific interest, are of much practical utility by enabling suitable means of protection to be ascertained in the case of organisms lending themselves for industrial utilization.

In the same hall is found a representative collection of art subjects, imitating the wonderful and most variegated forms of marine organisms. Besides the most modern productions in this connection are represented ancient Greek models with pictures of fishes, crabs, and dolphins as well as Japanese engravings, which show an admirable treatment of fishes.

The two underground or basement stories opening on the sea are admirably lighted, and apart from the aquarium hall, are not accessible to the public, being set apart for laboratory and research work. The upper basement story contains those rooms in which the collections are made ready for exhibition and study, in addition to a number of private laboratories, and a special library intended for the benefit of students in oceanography.

Every laboratory contains fresh-water and sea-water conduits, and a special experimental table designed by Dr. J. Richard, Director of the Museum, and where the animals under test can be kept alive for any length of time. Two of these private laboratories are especially equipped for researches relating to chemistry, ocean physics, physiology, etc., whereas the four remaining are set apart for zoological, botanical, histological, etc., investigations. A large photographical laboratory is installed at the eastern end of this story.

In the lower basement story is found a workshop destined for different kinds of rough work, especially the mounting of big animals, such as large fishes, whales, seals, etc. The numerous apparatus installed therein are operated by a gas motor. A special room is reserved for the dressing of fish and whale skeletons.

Two rows of aquaria are installed in the eastern wing of this underground story. An enormous iron-concrete table 21.40 meters in length, and 0.87 meter in width, parallel to the first row of aquaria (between the latter and the windows) is destined to receive a large number of transportable aquarium tanks of various sizes, the overflow from which is discharged direct on the table, the latter being so inclined that the whole of the water is collected in a central trough. These excellently lighted research aquaria will allow of a multitude of physical and biological researches in the field of oceanography. In the small aquarium basins can be investigated those smaller size animals which, being lost in the large aquaria, have to be conveniently isolated in conditions corresponding to their particular mode of life.

The sea water, derived from a rocky spot where owing to the continual whirlpool it is always fresh and well aerated, is thrown by two electric pumps to 64 meters height. From the receiving tank the water is supplied over a fall of several meters to the aquaria, allowing these tanks to be automatically aerated.

The Oceanographic Museum thus is not only an institute intended for the instruction of the general public, but a center of scientific investigation where students of oceanography will always be sure to find an equipment more comprehensive than anywhere else in the world.

The Seine at Paris runs between two stone walls in a channel that is spanned by many bridges. The width of this channel may be seen by noting that the largest and finest of these bridges—the

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Inquiry No. 8018. For manufacturers of "Wydt's Electro Catalytic Sparking Plug."

FINANCIAL BACKING wanted by an inventor. Great opportunity for manufacturers. Very fascinating article, first of its kind. Partners for foreign patents wanted. Address H. Schlommer, Effingham, Ills.

Inquiry No. 8087. Wanted the manufacturers of the Van Winkle, Woods & Sons and the Weber power meters.

100 PER CENT profit selling the Lindsay soft inverted mantles; fit any inverted gasoline light. Steady customers in every town. Fine side line for salesmen. Vest pocket samples and prices on request. Lindsay Light Co., Dept. H, Chicago.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

FOR SALE.

FOR SALE.—Interest or control in manufacturing business. Exceptional opportunity for manager or instrument maker. Control, Box 773, N. Y.

Inquiry No. 9016. Wanted, machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

Inquiry No. 9019. Wanted catalogues and all information on machinery for braiding straw in manufacturing straw hats.

FOR SALE.—Patent No. 68,281. An improvement in electric railway of the underground trolley type. For further information address 4804 Shenandoah Avenue, St. Louis, Mo.

Inquiry No. 9038.—Wanted, the address of the Chipman Electric Purifying Co.

PATENTS FOR SALE

PATENT FOR SALE.—No. 865,052. Sleigh attachment for automobiles. P. M. Knutson, Clifford, N. Dakota.

Inquiry No. 9066. Wanted to buy machinery to manufacture seed corn racks.

WANTED

SAFETY RAZOR. I wish to buy a good design or would consider purchasing patent. L. F., 700 Jamaica Avenue, Brooklyn, N. Y.

Inquiry No. 9075. Wanted to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

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COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9076.—Wanted the address of parties in Canada who could make a safety razor.

SALE AND EXCHANGE.

FOR SALE.—Engine lathe. Our regular $75.00 lathe complete, with a face plate, two centers, wrenches and a full set of change gears to cut all size threads. Price only $45.50. L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9078. Wanted, the address of manufacturers of sewer pipe made of fiber and asphaltum suitable for laboratory use.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

MISCELLANEOUS.

WE are about to complete a large contract for Taximeters and are therefore in a position to take up experimental work, manufacture of fine instruments, parts for the same, dies, jigs, etc. Precision Tool & Instrument Co., 9-15 Canal Place, New York City.

Inquiry No. 9083. Wanted, the address of firms manufacturing small beer brewing plants, from 15 to 25 gallons a day.

Inquiry No. 9094.—Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9096.—Wanted, the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted, address of makers of impulse water wheels.

Inquiry No. 9099.—Wanted address of manufacturers of machinery for making wire cables.

Inquiry No. 9101.—Wanted addresses of manufacturers of a dip or magnetic needle, for exploring for iron ore.

Inquiry No. 9107.—Wanted addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9113. Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114.—Wanted a machine for making pen nibs, similar to Wm. Mitchell's G & J nibs and Waverly nibs.

Inquiry No. 9117. Wanted names and addresses of the manufacturers of pedometers.

Inquiry No. 9118. Wanted, a muffler for a gasoline engine built upon the principle of the Maxim silencer recently brought out for use on rifles.

Inquiry No. 9119. Wanted, name and address of the manufacturer of Berlin bullet proof cloth.

Inquiry No. 9120.—Wanted, the address of the Ideal Fuel Feeder Co.

Inquiry No. 9121.—Wanted manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9124. Wanted name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9127. Wanted, address of L. Dermigny, manufacturer of a family ice machine for $10.00.

Inquiry No. 9133.—Wanted, manufacturers of a gasoline traction engine with a hoisting attachment; in other words, the machine will be used as a portable stump puller to pull sassafras roots, used in making oil of sassafras.

Inquiry No. 9134.—Wanted, a small hydraulic motor, capable of giving about one horse power with a water power of 65 lbs. per square inch.

Inquiry No. 9135. Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted, the address of manufacturers of machines capable of forming a number (12 or more) of pieces of paste about 25 mm. x 25 mm. x 6 mm., made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 1 mm. The process could be somewhat similar to biscuit making.

Inquiry No. 9139.—Wanted, the name and address of some manufacturer of a coffee mill run by water motor.

Inquiry No. 9140.—Wanted, manufacturers of disc records for gramaphones that use a sapphire point instead of a steel needle.

Inquiry No. 9142.—Wanted, name and address of the manufacturers of an air mattress.

Inquiry No. 9144.—Wanted, manufacturers of machinery for making soda water tubes, commonly known as straws.

Inquiry No. 9145. Wanted, to buy machinery to load blasting caps or detonators.

Inquiry No. 9149.—Wanted, manufacturers of machinery for roasting coffee for small and large industries.

Inquiry No. 9150.—Wanted, manufacturers of machinery for the manufacture of French heels for ladies' shoes.

Inquiry No. 9152.—Wanted, the address of the Graham Safety Lamp Filler and Ventilator.

Inquiry No. 9153.—Wanted, name and address of manufacturers of a knotless clothes line.

Inquiry No. 9154.—Wanted name and manufacturers of a newspaper vending machine.

Inquiry No. 9155.—Wanted, the address of manufacturers of an electric milking machine.

Inquiry No. 9157.—Wanted, manufacturers of peanut shelling and cleaning machinery.

Inquiry No. 9161.—Wanted, a machine that will grind oranges, pulp and skin into a smooth liquid or cream.

Inquiry No. 9162.—Wanted, addresses of shirt makers in Manhattan, who will make a few shirts of special design.

Inquiry No. 9163.—Wanted, manufacturers of a crank worked by clock work.

Inquiry No. 9164.—Wanted manufacturers of a vacuum pump that will exhaust from 25 to 400 c. b. inches of air per stroke and built as light as possible.

Inquiry No. 9165. Wanted, names and addresses of parties having deposits of colored silica sand, or colored rock that is being crushed into sand.

Pont Alexandre Trois—is but 353 feet long. The constriction of the flood waters within this relatively narrow channel was impossible, so it overflowed a large area along the banks of the Seine.

DR. ROBERT KOCH.

(Concluded from page 488.)

trypanosomes which are the specific cause of the sleeping sickness, and there Koch elaborated most important prophylactic and curative measures against this most melancholy disease.

This faithful servant of his race never rested. Coming from Africa, he took part in the International Congress at Washington, observing then "I wish to devote myself for several years to come, to further investigations of these problems"—and this in his sixty-fifth year.

Thus Koch's sojourn among us means this. Formerly men folded their hands supinely in the presence of horrible infections, now we know that by means extraordinarily simple and practical (how amazingly simple, *after they have been evolved*, are the conclusions of genius), by the rational use of our faculties, and by realizing that we ourselves are coefficients in the working out of our own destinies, it is indeed within our power to be rid of those infections which have up to our time prematurely destroyed half our race.

THE COLLECTION OF BUTTERFLIES.

(Continued from page 484.)

in the cyanide bottle, where it will quickly die (9). However, care must be taken in all these operations not to bruise the wings of the butterfly or moth. There are serious objections to this mode because the cyanide is poisonous, and even the fumes, if inhaled will prove dangerous. Although this method may yield good results to some collectors, I have always used a simpler and more effective way. A bottle with a medicine dropper as a cork is filled with benzine or gasoline (8). The insect is secured in the same manner as previously explained, and a generous dose of benzine is administered, which kills instantly. The benzine will spread over the whole specimen, but soon evaporates and leaves the insect none the worse for the bath. When the insect is dead, it is placed in a paper envelope made in the manner shown in 10.

Some of the large moths have greasy bodies, and will, therefore, have to be degreased. This may be done by placing the envelopes containing the insects in gasoline for twenty four hours or more.

Spreading the Insects.—If on reaching home there is time to spread the insects caught during the day they should be taken out of the papers and treated in the following way. For use in spreading, a perfectly flat board with an absolutely smooth surface, some insect pins, some pieces of plate glass of different sizes, and a few needles stuck into match sticks are needed. The insect is taken between the thumb and the index finger, and an insect pin is pushed through the thorax, as demonstrated in 11. With a broad-tipped tweezers, which may be purchased at any instrument maker's for a small sum the wings are taken hold of where they join the body, and are gently bent open until they remain in a horizontal position. Then the insect is placed upon the board and the pin is pushed in. Now a pin is inserted behind the heavy vein, and the wing is gently drawn forward until its base is perpendicular to the body. The pin is pushed into the wood. This operation is repeated with the other wings, and strips of glass are placed on them to press them flat. The pin which was first thrust through the thorax is now gently extracted. While the pin is being withdrawn, the pieces of glass should be held with the thumb and the first finger of one hand. The insects are left on this board for a week or two, and may then be removed for mounting (14). If the insects have

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(Concluded from page 490.)

been left for any length of time in the triangular papers, they must first be relaxed or softened. This may be done by placing them over night between moist cloths in a box, adding a few drops of carbolic acid to prevent mildew They should then be spread in the manner previously explained.

Mounting.—The last step in the preservation of the insects is the mounting There are various ways in which this may be done, but the writer knows of none better than that invented by Denton Brothers of Wellesley, Mass Cases of glass are made, varying in size with the size of the insect to be inclosed These cases permit of a clear view of both the upper and under side of the specimen, as the top and bottom are made of glass. The insect is supported by its wings on a glass shelf (15) When the insect is placed in position, the top which is hinged at one edge is closed over it and is sealed with the passe-partout binding which forms the sides of the box So simple is this method of mounting, that even a child can obtain very fine results The mounts can be obtained at prices ranging from five cents up There is another mount with which good results can be obtained—the Riker insect mount. These mounts consist of a neat cardboard box having a glass top cover and filled with fine cotton batting, in which the insect is readily embedded The glass cover when closed holds the insect in place The only objection to these mounts is that both sides of the insect are not visible, and therefore two specimens will have to be mounted to show both the upper and under sides. Riker mounts may be obtained from all instrument makers having a natural history department

Collection of Specimens —Now that the method of mounting and preserving the insects is known, the next thing to be done is the collecting of specimens But terflies may be found in the open fields which are covered with wild flowers or in the sunny openings in the woods Here the collector must stalk them Never run after a butterfly You probably will not catch it and moreover may scare others resting near As soon as the butterfly alights upon a flower, approach it carefully until within about five feet, then with a rapid sweep of the net capture it The moths are harder to find because they fly at night The method most often resorted to by collectors is known as sugaring A mixture of brown sugar, stale beer and molasses is made, and at dusk is painted upon the trees. In a few hours, if the locality is productive the moths will be hovering about the trees in abundance, keeping the collector busy half the night.

Naming and Classifying —When the insects are mounted they will have to be named and classified Butterflies and moths belong to the order called *Lepidoptera* Few people know the difference between butterflies and moths There are several great differences In the first place, all butterflies have club-shaped antennæ or feelers, that is, the feelers terminate in a club All members of the order Lepidoptera which have not club-shaped antennæ are moths In the second place, all butterflies are diurnal that is, they fly by day, while most of the moths are nocturnal or fly by night Several minor differences may be noted, the first of which is, that butterflies generally hold their wings erect when at rest, whereas most of the moths fold them down Secondly, butterflies transform from the caterpillar stage to the winged stage in a naked chrysalis, and moths have a covering, no matter how primitive, which is called a cocoon.

Reference Work.—In all entomological work standard books are necessary in order to identify the specimens. Dr Holland's Butterfly book and his Moth are standard American works, and in them may be found colored plates comprising pictures of most of the butterflies and moths of North America, north of Mexico, with pictures of their caterpillars, chrysalids, and cocoons

BERTILLON AND THE BURGLAR'S JIMMY.

(Concluded from page 484.)

two dynamometers of unequal power The stronger dynamometer having a maximum capacity of one ton and designed for the measurement of vertical efforts is connected to the top of the frame by a screw, by means of which it can be raised or lowered a few inches The lower spring of the dynamometer is attached to a heavy vertical steel plate, which slides in grooves along the two vertical posts When the index of the dynamometer is at the zero point, the bottom of this plate which is about 1½ inches thick, is about ¾ inch above the sliding horizontal plate In this interval is inserted a wooden board ¾ inch thick, with its edge flush with the bottom of the vertical steel plate The experiment is made by inserting between the board and the vertical steel plate the end of a "jimmy" or other burglar's tool and endeavoring by moving the handle of the tool up and down, to produce on the board impressions similar to those which have been found on doors and furniture The index of the dynamometer moves in accordance with the effort exerted and by means of a second index which remains fixed when the first returns to the zero mark the instrument automatically registers the effort required to produce a given impression

The figure thus obtained indicates only the vertical effort or effort of pressure but there is always a horizontal component of greater or less magnitude and this is registered by a horizontal or traction dynamometer, which is attached to the sliding horizontal steel plate

Either of the dynamometers can be used alone or both can be employed simultaneously In this way it is possible to measure the horizontal and the vertical efforts separately or in combination In the latter case M Bertillon has found that, as might be expected the horizontal effort is always much smaller than the vertical or pressure effort For example, using a lever 20 inches long a vertical pressure of 1 300 pounds was obtained simultaneously with a horizontal traction of 330 pounds A strong man, operating on a hard walnut plank can develop a pressure effort of 1 500 pounds

The apparatus can also be turned over on its side so as to place the experimental board in a vertical position for the purpose of investigating the forcing open of a door In this case a second piece of wood is introduced to represent the jamb of the door The same arrangement in the normal position of the apparatus, is used for investigating the opening of a drawer or a cylinder or other desk etc

The idea of employing a dynamometer in the study of burglary appears so simple, that it is surprising that it was not done long ago Henceforth judicial inquiries will be guided by the results of a series of experiments which will furnish points of reference From measurements made with the Bertillon dynamometer it is possible to discover whether the burglarious entrance was effected by a man, a woman a child or several persons

Finally the study of the impressions made by tools has led M Bertillon to give these impressions distinct names according to the part of the tool by which they are produced The word "foulée" is reserved for the impression made by the point of the tool "écornure" for the notch made by the body of the tool in pressing on the edge of a door or piece of furniture, and the word "pesée" for the indentation produced by the elbow of a "jimmy" or similar tool on a plane surface For the identification of the tool the most valuable evidence is furnished by the "foulée"

SCIENTIFIC AMERICAN

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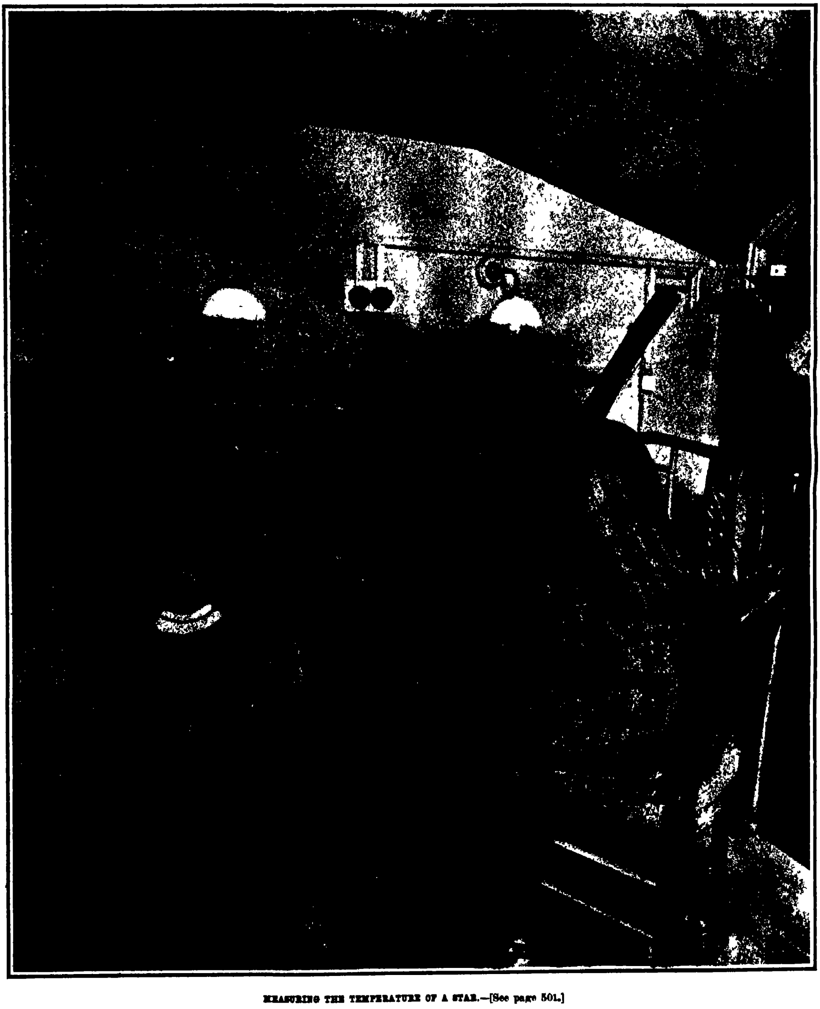

MEASURING THE TEMPERATURE OF A STAR.—[See page 501.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A STEEL ARCH SUGGESTED FOR THE QUEBEC BRIDGE

AT the time when the plans for the 3,100-foot Hudson River bridge were under discussion and it was generally accepted that the only type of structure that would lend itself to the then unprecedented span of 3,100 feet was either the cantilever or the suspension bridge, there appeared a remarkable paper by the well known bridge engineer Max am Ende, in which a design was presented for a steel arch bridge of 3,000 foot span, which was to be erected on the cantilever principle, the load, during erection, being carried by tying it back to suitable shore anchorages until the final keystone was in place. In a recent issue of Engineering News, a similar proposition is made by Charles Worthington, for the construction of an 1,800-foot steel arch at the Quebec Bridge crossing. The elevation of the bridge shows the characteristic beauty of the steel arch. Mr. Worthington is convinced as the result of a study of the problem, that not only would an arch of this magnitude be practicable, but that in point of cost it would compare favorably with a bridge built on the cantilever or the suspension principle, provided, of course that suitable abutments could be provided to take the enormous horizontal component of the thrust. This it is proposed to do by constructing a huge concrete strut, or compression member, [illegible] ground, extending from the base of the piers to the rock of the river bluffs. Each strut is 20 feet [illegible] and 98 feet in width, and should therefore [illegible] sufficient for its purpose.

Certainly, the most difficult problem is that of erection, and Mr. Worthington proposes to solve this by the original method of building an erection suspension bridge entirely across the site, and suspending the individual voussoirs, of which the main arch is composed, from the cables, the lower ends of the latter being provided with adjustment devices by which the voussoirs can be held in proper position during erection. The abutting faces of the voussoirs would be accurately machined and provided with flanges by which each section after it was lowered into position would be secured to the erected portion of the arch. The arch consists of four parallel ribs of hollow rectangular section, each 21 feet deep at the crown, 42 feet deep at the skewbacks, and 9 feet wide. When the keystone of the crown had been lowered into place and riveted up, the suspended cables would be slacked up and removed, and the whole suspension bridge taken down leaving the four great ribs of the arch ready for the erection of the supporting columns and the superstructure of the floor.

The element of doubt which enters into this design is due to the system of erection adopted. It is questionable whether, with the flexible support afforded by the suspension cable it would be possible to hold the voussoirs with that absolute accuracy and rigidity which is necessary. It is well understood that during erection voussoirs must be kept in exact position by absolutely rigid falsework. Max am Ende was able to secure this rigidity by designing a frame-arch bridge, and tying back the successive sections, as they were added, to rigid anchorages on either shore. Furthermore because of the great weight of the bridge, whose dead load over the whole 1,800-foot span is estimated at 26,000 tons the erection suspension bridge would have to be extremely heavy and costly. It is but fair, however to quote Mr. Worthington as stating that the estimates of the total cost of the structure indicate that it compares very favorably with the cost of a cantilever structure, even if the elaborate erection plant be considered to have no subsequent salvage value.

SIX THOUSAND MILES IN AN AEROPLANE.

IT is doubtful if any one, among the many thousands who have witnessed Hamilton's spectacular flights at Mineola, Long Island, and wondered at the bird like facility with which he performed his evolutions, realized that his success was the outcome of some six thousand miles of actual flying which he had done during the past six months.

In qualifying for the degree of "bird man," Hamilton has served a long apprenticeship and has traversed the whole gamut of aeronautical experience. Of light but athletic build, quick but cool, and richly endowed with that intelligent daring which is so essential to success in aviation, he has probably had a more varied experience in the air than any other living man. He has been carried up by kites, has not hesitated to cut loose in gliders at dizzy altitudes, and sweep through perilous distances to earth, and with balloons both spherical and dirigible he is altogether familiar. With so much accumulated experience of the "feel of the air" at command, and with his rich endowment of the natural qualities of an aviator, it was inevitable that, when Hamilton took his seat in an aeroplane, he should quickly become one of the most, if not the most, experienced and successful exponents of the new art of human flight. Starting last November with a Curtiss machine, he has spent the intervening months in touring the country and teaching the public to what a pitch of perfection human flight has been carried. Four days a week, for the past six or seven months, he has given exhibitions throughout the country, largely in the West and Southwest, making on each occasion four or five different flights. Hamilton estimates that the total distance that he has flown through the pathless air in the intervening period is approximately six thousand miles, or sufficient to have carried him from New York to San Francisco and back. Just here we should remark that it is fitting that a Hamilton should leave his impress so strongly on the pages of aeronautical history in the United States, since he is a direct descendant from John H. Hamilton, the brother of Alexander Hamilton, John H. being the great great grandfather of the present Charles K. Hamilton.

During a recent conversation, and at the request of [illegible] summed up con[illegible] learned during these [illegible] under a wide variety [illegible] scattered points in [illegible] wind," said Ham[illegible] all over again, [illegible]ly different from [illegible] but with coolness, [illegible]blem may be thor[illegible] in windy weather [illegible]ity. Large crowds [illegible] other open spaces, [illegible]tly, when the ap[illegible] be winds of con[illegible]y times, and par[illegible] winds that were [illegible] an hour, and over in Tucson, Arizona, for instance, the government gages showed that on the afternoon of my exhibition, the wind was blowing thirty three miles an hour. My 8-cylinder, 50 horse-power Curtiss machine was brought out, and held in position facing the wind. As the propeller revolutions increased, the thrust reached a point at which the machine began to lift, and on letting go, the crowd were astonished to see me apparently flying backward. As the motor gained velocity, I first became stationary over the starting point, and then, with full power developed, traveled over the ground at a speed, relatively to the ground, of ten to fifteen miles an hour." On another occasion, at St. Joseph, Missouri, Hamilton rose and gave successful exhibitions in a wind which the local government anemometers registered at thirty nine miles an hour. The young aviator considers that the bugaboo of the wind has been eliminated, and that from now on the skilled "bird man" will no longer wait around for three-fourths of a windy day in the hope of making a flight in the remaining fourth. It is not the velocity of the wind, but the sudden changes in the velocity, that constitute the peril. In a gusty twenty-five-mile wind, the velocity will suddenly change, in the puffs, from fifteen to twenty-five miles, a difference of ten miles per hour, and the range of difference increases with the increased speed of the wind.

AUTOMATIC CONTROL.—Asked for his opinion of the value of automatic control, such as might be afforded by pendulum action or by the gyroscope, Hamilton surprised us by affirming that he did not believe in such control. "The pendulum effect would tend to become rhythmical, and the swing might be in the wrong direction at the critical time; on the other hand, the resistance of the gyroscope would be too rigid, and in sudden gusts it might be such as to cause the breaking of the planes by transverse bending strains." When flying in a gusty wind, the sudden upsetting forces must be met and resisted gradually, and the machine brought back to the normal position "with a loose curb" much as a skillful rider will control a spirited and sensitive horse. "The manipulations necessary to right an aeroplane are too complicated and inter-related to be capable of absolutely automatic control," said Hamilton, "as you will see from the following: If a puff hits the right side and lifts it, there are three distinct motions necessary to restore equilibrium. First the wing tips or ailerons must be set to counteract the lifting force; then the front horizontal rudder must be sharply depressed to throw the machine down and gain velocity; and thirdly, the rear vertical rudder must be swung over. These movements must be done with judgment and a delicate touch, and it is difficult for me to understand how the sensitive hand and intelligent mind of the aeronaut could be replaced by purely automatic appliances in a complicated evolution of this kind. Furthermore, for perfect control, there must be a certain amount of anticipation of what is going to happen. Experience teaches the aviator to recognize different atmospheric conditions, he adjusts himself to these and in his manipulation of the control, anticipates the vagaries of the wind. These are conditions which a purely automatic control could never meet."

WING SURFACE AND SPEED.—Hamilton looks for considerable increase in the speed of aeroplanes in the near future, and believes that some of the more powerful machines now being built will have made seventy miles an hour before the close of the present year. As to the far future, the high-speed racing machine will probably be a monoplane, with long, narrow wings, affording small supporting surface relatively to the horse-power. One of the most interesting facts developed during the varied experience of the past six months was the accidental verification of the important principle enunciated by Prof. Langley, that the higher the speed of an aeroplane the less is the necessary sustaining surface. It happened that in adjusting the engine at the commencement of an afternoon exhibition, the intake valves and carbureter caught fire, and several panels of the central covering of the upper and lower planes were burnt out, leaving only 150 out of 250 square feet of surface intact. Rather than disappoint the assembled crowd of 8,000 people, Hamilton determined to try for a flight. Ordinarily, a 100 to 150-foot run would have been sufficient, but in this case it was not until the machine had run over 1,000 feet, and the engine was working at its maximum power, that the machine lifted. Immediately Hamilton discovered that he was flying much faster than he had ever done before, which, of course, was strictly in accordance with the above-mentioned law of flight.

Here is a hint that the racing machine of the future will have some system for reefing, which will allow the sustaining surface to be reduced, and skin friction eliminated as the speed increases. Conversely when flying at El Paso, in the rarefied air due to an elevation of 3,980 feet, Hamilton found at first that he could not get off the ground at all. The sustaining planes were lengthened, and 135 square feet were added to the normal area of 250 square feet. With this increase, the machine rose, and successful flights were accomplished. As the result of this experience, Hamilton believes that records of high flying in which the machine reaches the rarefied strata of air, should be accepted with considerable caution.

Not very long ago, timber was selected entirely according to its external appearance. The diameter and length of the piece, the straightness of grain, sometimes the weight, sufficed to determine both its commercial value and its destination. At that time, on account of the difficulty of transportation, woods of local origin were almost exclusively employed. It is very different nowadays. With the increase in consumption and the decrease in the local production of wood, it has become necessary to transport timber of every variety and of many places of origin. Furthermore, the diversified industries of the present day require a corresponding diversity in the wood employed. For one purpose, the important quality is hardness, for another, elasticity; for a third, ease of working, or resistance to attack by external agencies. It is evident that very different qualities are required for an umbrella handle, a barrel stave, a billiard cue, a carriage frame, etc. The hand magnifying glass, which was first employed, has ceased to suffice for the exact determination of the structure of wood. The compound microscope is now used for the minute and careful examination of longitudinal and transverse sections of a specimen of timber, the commercial value and the proper industrial employment of which it is desired to determine. Fine-grain and thick-walled cells assure the solidity and resistance which are required in carpentry, and these qualities are incompatible with an abundance of parenchymatous tissue filled with starch.

ENGINEERING.

[illegible] for raising the Lighthouse Board to the dignity of a government bureau with a single head to manage it. A commissioner will act as executive officer, and it is proposed to place the service in the hands of specially-trained civilians, who will not be liable to withdrawal for active service (as happens with army and navy officers) in case of war.

Referring to our recent article on the six Mallet freight compounds for the Delaware & Hudson Railroad, it is of interest to note that the four frames of the engines, each weighing about 8,000 pounds, are built of vanadium cast steel, having a tensile strength of 80,978 pounds per square inch and an elastic limit per square inch of 45,924 pounds, as determined by tests made while the frames were at the foundry.

A dispatch from Berlin states that the "Von der Tann," the first of the German dreadnought cruisers, reached, on her preliminary trials, a speed of 28 knots. This, if true, places her, in respect of speed, abreast of the British "Invincibles." The latest accounts credit her with carrying eight 11-inch guns disposed in four turrets, one forward, one aft, and two *en echelon* amidships. The displacement is about 19,000 tons.

Figures just compiled by the Pennsylvania Railroad system show that although in 1908 and 1909 its various lines carried a total of 299,762,658 passengers on its 24,000 miles of track, only one passenger was killed as a result of a train wreck. In other words, the chance of a passenger losing his life in an accident on the Pennsylvania Railroad system was one out of about 300,000,000.

The naval board which conducted the tests of the ship brake recently fitted to the battleship "Indiana" reports that, though it will stop a vessel in a short distance, it is unsuitable for naval uses. It considers that unless the brake were constantly employed it would become clogged with barnacles. It would also increase the danger from torpedo attack, would be dangerous in close evolution, and would at all times somewhat retard the speed of a ship.

Secretary of the Navy Meyer announces that he has approved the plans of the two new battleships which have been voted by the Senate and House. Each will be of 27,000 tons displacement and will carry an armament of ten of the new and extremely powerful 14-inch guns. In general appearance, in armor plan, and in disposition of the guns the new ships will resemble the "Florida," which was recently launched at the Brooklyn navy yard.

A comparison of the strength of the navies of the world in dreadnoughts shows that Great Britain has seventeen of 353,700 tons displacement, Germany thirteen of 275,000 tons, the United States ten of 221,650 tons; Japan six of 118,410 tons, Russia four of 92,000 tons, and Italy four of 80,000 tons. France has none of the strictly dreadnought type, either built or building. The above figures include both ships completed and those under construction.

Hollow steel masts are not the only kind that carry away. The English racing yacht "Brynhild" recently lost her solid wooden mast which, in falling, seems to have driven through the light shell of the yacht, causing her to fill and sink in fifteen minutes. The "Brynhild" was racing against the seventy-footers "Shamrock" and "White Heather." Usually the falling mast entirely clears the hull, as happened in the case of both "Columbia" and "Shamrock" I and III during their respective "America" cup racing seasons.

The board of engineers appointed by the Board of Estimate of this city to pass on the plan to distribute the new Catskill water supply in the various boroughs by means of a deep tunnel, one hundred feet or more below the surface, has reported that the tunnel would cost only $36,000,000, as against $47,000,000, which would be the cost of building a system of pipe lines. The construction is recommended on the grounds both of economical first cost and small future cost of maintenance.

The four dreadnoughts which are being built for the Russian navy in Russian yards will have several novel features. They will be 590 feet long, 89 feet beam, of 23,000 tons displacement, and with 42,000 shaft horsepower are designed to make 23 knots. An armament of twelve 12-inch guns is to be mounted in four three-gun turrets placed on the center line. All turrets are on the upper deck, one forward, one between the smokestacks, another between the after smokestack and the mainmast, and the fourth on the upper deck. The belt armor will be 8.8 inches maximum thickness, which is rather light, but the [illegible]

AERONAUTICS.

Capt. Baldwin and Joseph Seymour both gave excellent demonstrations on the 4th instant of their proficiency in flying their machines. The latter's biplane is a standard 25-horse-power Curtiss, while Capt. Baldwin has a Curtiss machine with a tail like the Farman and with a chain-driven propeller placed back of the planes and connected to the 25-horse-power motor. The propeller used is somewhat larger in diameter and of higher pitch than that ordinarily employed.

Jacques de Lesseps crossed the Channel on the 21st day of May by way of Calais to Dover with a Blériot monoplane, and thereby won the Ruinart prize of 12 000 francs. Count de Lesseps started from the same downs at Barraques, near Calais, from which Blériot ascended on his memorable flight. The Count ascended at ten minutes to four o'clock in the presence of 2,000 spectators. His motor was a Gnome, revolving-cylinder engine of 50 horse-power At a height of 1,600 feet he was lost in a heavy fog The torpedo boat "Escopette," which performed a similar service for Blériot and Latham, accompanied him, but found it impossible to keep up De Lesseps was unable to adhere to his course, partly perhaps because of the fog, and as the "Escopette" entered Dover, no one knew anything at all of De Lesseps. He had landed about two miles to the north of Dover, near St. Margaret, and glided down a distance of about two miles after shutting off his motor He alighted at twenty two minutes after four, after a journey of forty-two minutes.

After Count de Lesseps's flight across the English Channel with the Blériot monoplane on May 21st (which was the second time this trip had been made by any aeroplane), the Hon Charles Stewart Rolls, who was the first Englishman to fly with a Wright biplane, on June 2nd succeeded in making a double crossing from England to France and return The start was made near Dover at 6 30 P M., and Mr Rolls covered the 21 miles to Sangatte near Calais in 35 minutes. After circling twice above the cliffs he returned to England, and landed some distance from the coast. Altogether he covered some 45 miles in about 75 min[illegible] ances of the Eng[illegible] on another page[illegible]

During the [illegible] were made at [illegible] are being used [illegible] ety and the Ae[illegible] new aviators inc[illegible] T A. Baldwin, [illegible] Harmon made [illegible] His machine can[illegible] and was slightly [illegible] present with hi[illegible] started to Mr. [illegible] distance from t[illegible] whereabouts, H[illegible] the propeller wh[illegible] climbed into hi[illegible] time he manage[illegible]

The latest and longest two-passenger cross-country flight was made on the 9th instant in France by Lieut Feguant and Capt Marconnet on a Henry Farman biplane Starting from Chalons at 4 40 A M the officers flew 176 kilometers (109¼ miles) cross country to the artillery park at Vincennes, which was reached at 7 10 This flight of two and one-half hours' duration was accomplished at a speed of 43¾ miles per hour. Capt. Marconnet was able to take photographs and make sketches that would have been of great strategic interest in time of war This is the first practical demonstration of the aeroplane for scouting purposes, in addition to its being a new world's record for cross-country flying with two men in the machine Another French aviator, Labouchère, flew for ten minutes with two passengers at Mourmelon on the same day

Previous to attempting a long-distance flight from New York to Philadelphia and back, Mr Hamilton gave some beautiful exhibitions of his skill in flying at Mineola the first week in June He would rise to a height of from 200 to 300 feet and circle about, at the same time swooping down to within 15 or 20 feet of the ground and suddenly rising again. When he was about to alight he would shut off the motor at a good height, and dive almost perpendicularly to the earth. When only 10 or 12 feet from the ground he would level up his machine, and make an extended glide only a few feet above the surface. He appeared to ride in the biplane as easily and with the same skill that a bareback rider rides his horse, and he seemed to take as much enjoyment from his dives and other pranks as did the large number of interested spectators. The machine he has used since last winter is the identical racer used by Mr Curtiss at Rheims. It is very fast, and has also demonstrated its ability to carry two people, since Mr. Hamilton took with a friend for a short spin on the 4th instant.

SCIENCE.

Prof. Dr. Hergesell, of Strasburg, president of the International Commission on Scientific Aeronautics, will accompany Count Zeppelin on his expedition to Spitsbergen this summer, and will carry out a series of aerological observations in that vicinity For this reason it is proposed to hold the "international week" of kite and balloon observations, in which meteorological institutions in all parts of the world participate, from the 8th to the 13th of August, this year, instead of during November, as previously intended

Bernard Brunhes, director of the observatory of Puy-de-Dôme, and professor of physics in the faculty of sciences at Clermont-Ferrand, is dead at the age of 42 He was the author of many memoirs on physical and meteorological subjects, and of late had been prominent as the champion of the new methods of weather forecasting introduced by G Guilbert of Caen Brunhes endeavored to explain on theoretical grounds the methods deduced empirically by Guilbert, but the extensive polemics on this subject in the scientific journals have not led to any conclusive results

A fund has been established by Mrs E H Harriman for the collection of complete data on mammals and other animals of the North American continent Dr C Hart Merriam chief of the biological survey of the Department of Agriculture, will resign from the government service to take charge of the work The late Mr Harriman was intensely interested in natural history It was with his financial support that Dr Merriam visited Alaska a few years ago and collected data which added much to our geological and biological knowledge of that region

Attempts are being made to produce textile imitations, equal or superior to natural furs in color, gloss, and adaptability to the ever-changing dictates of fashion, and very much cheaper The substitution would have the further advantage of releasing the natural skins, especially goat skin, for use as leather Mohair and other long-staple wools are most suitable for this purpose A recent issue of the Faerber Zeitung contains a detailed description of the process of making imitation furs, including the operations of [illegible]ling, dyeing with acid dyes, precipitating manga[illegible] dioxide on the fibers, steeping in alkali, and [illegible]forming the *bistre* shade produced by the manga[illegible] dioxide into green, blue or grayish brown

[illegible] has long been well known that the rural popula[illegible] is superior to the population of the cities, and [illegible] population of the agricultural eastern provinces of [illegible]many is superior to that of the manufacturing [illegible]tern provinces in regard to fitness for military [illegible]ice The forty-one large cities which contain one-[illegible] of the entire population of Germany, furnish only [illegible]per cent of its soldiers. Berlin makes the poorest [illegible]wing of all, furnishing only 39 per cent of the con[illegible]ent which it should furnish in accordance with its [illegible]ulation Hamburg furnishes 42 per cent of its [illegible]per share, Bremen 65 per cent, Alsace-Lorraine 78 [illegible] cent The deficiencies are made up by the eastern [illegible]vinces. East Prussia furnishes 140 per cent of its [illegible]per share, West Prussia and Posen 129 per cent, Pomerania 123 per cent, Saxony 134 per cent The average height of the recruits from the north of Germany exceeds that of the recruits from the south The average height for the whole empire is 66 inches, the average for Mecklenburg, Schleswig-Holstein, and Oldenburg is 66½ inches, and the average for Saxony and Silesia is only 65½ inches

Carborundum, which consists essentially of silicon carbide is produced in the electric furnace from a mixture of sand, coke, sawdust and common salt. With the exception of the diamond, carborundum is the hardest of all known substances, scratching even corundum, which is the hardest of natural stones except the diamond The commercial production of carborundum was first accomplished by Acheson, and the Carborundum Company which he founded produces in its works at Niagara Falls large quantities of carborundum, which is in great demand as a polishing and grinding material The carborundum hitherto produced contains a trace of uncombined carbon and consequently has a dark brown or black color, which makes it unsuitable for decorative purposes Recently however Frank Tone of the Carborundum Company, has devised a method of producing colorless and transparent crystals of carborundum, the refractive index of which is said to be even greater than that of the diamond These crystals are produced by charging the furnace with a mixture of 30 parts of pure carbon, 37 parts of quartz, 9 parts of sawdust, and 4 parts of salt. All trace of color is removed from the crystals by the addition of a small quantity of a metallic oxide, such as oxide of chromium As the refractive power of the diamond is one of its most valuable properties, and the carborundum crystals possess this property in a still higher degree, these new gems may become serious rivals of the diamond, if they can be produced in suitable shapes and sizes, and can be cut and polished like diamonds.

A TELEPHONIC STETHOSCOPE

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

Telephone relay with casing removed

Great interest has been centered among British telephonic and medical circles in the interesting device invented by Mr S G Brown which was recently described before the Institution of Electrical Engineers The vital feature of this invention is the successful perfection of a telephone relay For many years inventors have been trying to develop such a relay but have been baffled by difficulties which many engineers have declared to be unsurmountable As the outcome of six years patient study and experiment however Mr Brown has achieved success as tests over the trunk telephone lines of Great Britain have strikingly demonstrated

This relay which is shown in the accompanying illustration and the design of which may be gathered from a reference to the explanatory diagram is [illegible]

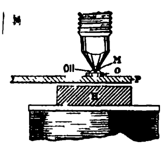


Fig 2 —The reed and contact pieces

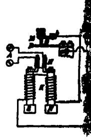


Fig. 3 —Electrical connections of the relay.

veloped upon entirely new lines and is based upon the researches of Prof J J Thomson Earhart Kinsley and others concerning the flow of electrons across a microscopic air gap between two conducting surfaces at different potentials Earhart found that when the metallic circuit is broken by a minute opening of the order of 0 000 000 5 centimeter and the metal at the point of interruption is platinum the current will flow round the circuit and across the opening and when this interrupting space which Mr Brown terms the conduction space is slightly altered in length the resistance is varied and the value of the current flowing round the circuit is greatly affected This constitutes the fundamental basis of Mr Brown's invention for he points out that this conduction space is just what is wanted for the current carrying device of a telephone relay where microscopic mechanical movements have to be converted into large current changes But the dimensions of this conducting space are so minute that it is a difficult matter to insure and maintain it by mechanical means Therefore he devised a method whereby the current flowing across the conducting space effects its own adjustment in very much the same manner as the current that passes through an electric arc lamp strikes and maintains the length of the arc

In the diagram Fig 1 there is a permanent magnet N which is continued by soft iron poles right up to, but not touching the invar steel reed P Two sets of coil windings H and K are wound round these soft iron pole extensions and the telephone currents to be magnified circulate round the winding H and consequently by varying the magnetism set the reed P in vibration There are top and bottom metal contact pieces M and O which are opened to an infinitesimal degree by the fine adjusting screw W, and by the action of the local current passing through the contact and around the winding K It is the action of the local current operating through this winding which forms and subsequently maintains the conduction space

This automatic adjustment is so absolutely perfect that the instrument may be turned upside down and yet produce scarcely any appreciable alteration in the value of the local current and certainly without exercising the slightest effect upon the action of the relay The regulating winding K however must not act when traversed by the rapidly varying telephonic currents and this end is assured by surrounding the iron under the coil by a closed circuited copper sheathing Eddy currents set up in this sheathing by mutual induction destroy the self induction of the coil In the instrument illustrated herewith the contact between the reed P and the contact pieces M and O is effected with metal pieces of hard osmium iridium alloy the top contact being pointed like a pencil (Fig 2) with the lower one flat and affixed to the reed Both are polished and work under a small drop of thin oil

The connections of the relay are shown in Fig 3 The telephone currents to be intensified enter by the terminals A and circulate through the winding H At C is a dry cell of normal voltage at K the low resistance regulating winding at T the telephone receiver of approximately 40 ohms resistance and at D an ampere meter or current indicator The relay usually acts at its best adjustment when the microphone contact is opened so as to reduce the local current to half its maximum value.

The extent to which it magnifies speech on ordinary lines is striking as trials have demonstrated and the great value of the invention is that the intensification of sound is secured without any perceptible loss in [illegible] work with large [illegible] receiver in its [illegible] comfortable loud [illegible] cable speaking [illegible] this relay is [illegible] to any length [illegible] now possible to [illegible] say supposing [illegible] direct speaking [illegible] the relay to the [illegible] be increased a [illegible] being placed [illegible] ater at the end [illegible] as a receiver at [illegible] telephone cur [illegible] increased to [illegible] Should still [illegible] desired then it is only necessary to place two relays in tandem by which means magnification is increased to 400 times Moreover if a piece of soft rubber be made to touch the reed to assist the natural electrical damping of the reed the voice can be transmitted more distinctly and clearly than if the conversation were taking place in a room owing probably to the complete absence of echoes

The introduction of the local regulating winding K converts the metal contacts M and O into microphones of extreme delicacy securing a far finer degree of sensitiveness than could be obtained by light pressure between carbons In view of this fact Mr Brown continued his investigations and succeeded in evolving an electrical stethoscope whereby the sound of heart beats and other internal organs is very greatly magnified

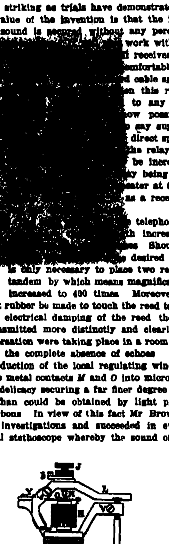
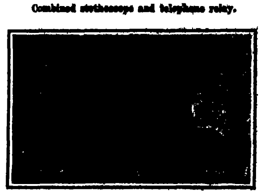


Fig. 1. View of the relay with the brass cover removed

A TELEPHONIC STETHOSCOPE.

Combined stethoscope and telephone relay.



Electric stethoscope with transmitter removed.

This stethoscope is highly ingenious and its design is shown diagrammatically in Fig 4 while the photographic illustration conveys an idea of its general appearance The transmitter if such it may be termed represented by A comprises a shallow brass cell faced with a thin diaphragm of ebonite This is placed upon the body in the region of the heart or other organ to be examined as with the ordinary instrument, and the sound of the beat or movement is conveyed to the ebonite diaphragm then to the air within the tube B to which the transmitter is connected setting the metal diaphragm D in vibration The contact pieces M and O are fashioned of osmium iridium M being mounted on the diaphragm D and O on the steel reed

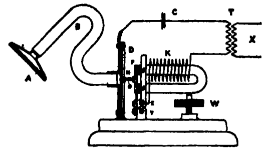


Fig 4.—Diagrammatic view of the stethoscope.

P The reed, together with the magnet N S is supported on a brass frame E pivoted or hinged at its lower support Y The conduction space is produced between the contacts M and O by the fine adjusting screw W and by the automatic action of the local current flowing from the cell C through the winding K and round the magnet A special telephone transformer of equal windings of about 20 ohms resistance is represented by T in the primary and in the secondary

With such an instrument as this the sound of the heart beat is intensified about three times But as such magnification is insufficient for practical purposes Mr Brown connects his telephone relay, as above described to the transformer wires X and the two instruments bring about a sound magnification of about 60 times or more

The instrument has been tested at the London Hospital where it was submitted to a number of [illegible] cated heart disease cases The physicians conceded that the instrument was far in advance of any stethoscope that they had previously used When it was applied directly to the heart the sounds in the telephone receiver were heard with uncomfortable loudness, and were even audible to the patient [illegible] as well as those standing around But as in such medical work other sounds in the human body, such as breathing which is [illegible] with the heart beat [illegible] Mr Brown has devised ways and means for [illegible] these extraneous and possibly [illegible] The metal diaphragm D and the reed P of the telephone relay are tuned to a [illegible] proportioning [illegible]

(Concluded on page [illegible])

A NEW SYSTEM OF COLOR PHOTOGRAPHY

Since the introduction of the Lumiere autochrome color-sensitive plate within the last three years, upon which a composite color picture is made at one operation direct in the camera, quite an impetus has been given to improvements in this line, which will overcome one of the drawbacks of the French process that is, the difficulty of securing duplicate color photographs except by successive exposures in the camera.

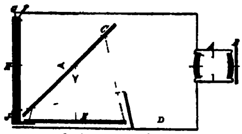
The new system we are about to describe has this particular feature, that duplicate color pictures can be obtained ad libitum from the first negative obtained in the camera. It has been perfected and simplified by Mr Frederick E Ives of this city and is quite unique in the way certain apparent difficulties are overcome

The process is based on the merging of the three primary colors, red, blue, and green It is not quite as simple in operation as the autochrome process but possesses the following definite advantages over that The sensitive plates used keep better developing successfully when several months old and cost but half as much as the autochrome plates the positive transparencies are made by a separate process from the finished negatives, thus permitting the making of any number of duplicates the transparencies transmit many times as much light as autochromes and are quite free from granularity so that they are perfectly adapted for use along with ordinary lantern slides in the lantern also for use in the stereoscopes the process also permits of local treatment to modify the colors when and where desired with extraordinary facility a feature which will be greatly appreciated by the artistic amateur

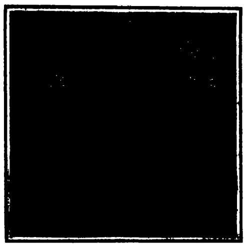
A special camera is required to make the triple negatives but it is very simple and can be used without change for all ordinary kinds of photography with plates or films

When it is desired to make a set of triple negatives for color photography a trichromatic plate pack consisting of three sensitised plates held together as one is used in the special plate holder instead of a single plate and is so disposed in the camera after the plate holder has been inserted as to produce by one exposure three negatives representing the three primary colors The plate pack consists of a red sensitive and a green sensitive plate with the sensitive or film surfaces in contact held between a backing card and a blue-sensitive plate which is hinged thereto by a strip of gummed paper When the pack is inserted in the plate holder the red and green-sensitive plates are retained by ledges and are pressed in close contact film against film by a spring on the lid but the blue-sensitive plate is made slightly shorter so that it falls or passes outward between the ledges. When the opaque slide of the plate holder is withdrawn in preparing for an exposure this plate falls outward into the camera resting on the bottom of the latter in a horizontal position at right angles to the other plates After this a yellow screen plate is dropped down from the camera roof by means of a lever on the exterior as shown in the diagram and the usual compensating screen is placed over the lens tube Then the exposure is made by means of the lens shutter which is said to be about as long as that required for an autochrome plate

Referring to the diagram, *A* is the lens having a compensating color screen *B* attached to it which equalises the exposure for the three images and perfects the color selection *C* is a hinged transparent



Interior arrangement of camera.



The camera, plate holder and carrying case

THE IVES SY[illegible]

yellow glass [illegible] dry plate [illegible] zontal posi[illegible] downward [illegible] image pass[illegible] green and [illegible] plates resp[illegible] tact with [illegible] the back [illegible] through [illegible] film on the red [illegible]

After [illegible] contact [illegible] outside [illegible] sition [illegible] lever on [illegible] the slide of the p[illegible]

H and *J* represent an opaque backing card and a flexible hinge attached to the plate *E* the plate *F* being loose but held clamped between *H* and *F* when the pack is closed

The plate holder is inserted at the back of the camera under a ground glass frame held by springs in the usual way Focusing is done by moving the lens inward or outward through a tube on the front

It is evident from this arrangement that the image on each plate must be exactly the same but that two of them will be reversed one by reflection and the other because made through the glass side of the plate

In making positive duplicates on the film it is only necessary to reverse the position of the print from the positive-positioned negatives to make all three positive prints coincide when bound together between two glass plates to form one harmonious transparent colored picture The collodion positive film is so thin that accurate registration of the three films is not affected

The exposed plates are developed by time development as a unit held in a special rack they being separated open like the leaves of a book in a tank filled with an amidol developer The resulting negatives show no color but contain the color record in black and white and when finished are available at any time for making natural color transparencies

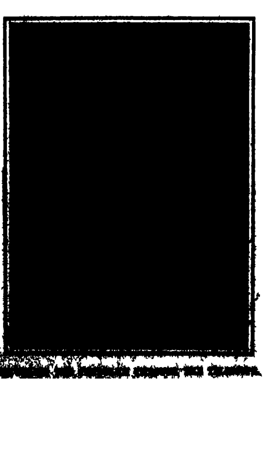
To make the transparent color prints the three negatives are placed side by side in a printing frame A sheet of collodion bearing a coating of bichromated fish glue is laid collodion side down on the negatives the back of the printing frame put in and then exposure made to light through the negatives—about one minute in clearest sunlight The exposed sheet is then removed from the frame clamped coated side up on a glass and developed by washing with water under a tap for a few seconds This gives three graduated low relief prints which are perfectly transparent but they are then cut apart and immersed in separate red blue and green dye baths for a few minutes (the dyes to be furnished in their proper colors) then rinsed off dried and superposed in register to make the complete natural color transparency The same negatives are available for color prints on paper but the processes for making color prints on paper are not yet [illegible] so simple and satisfactory as the transparency [illegible]

[illegible] appearance of the camera and plate holder and [illegible] case for carrying the apparatus is shown in the [illegible]ration It is quite compact and simple Ex[illegible] of these pictures both in the form of lantern [illegible] and stereoscopic transparencies have been shown [illegible] they possess a most pleasing brilliancy and [illegible]parency in coloring just as one would like to see [illegible] should be mentioned that Mr Ives [illegible] system succeeded in developing and perfecting [illegible] half tone and half tone three-color processes several [illegible] ago and may be regarded as one of the pioneers [illegible] color photography For some of these discoveries [illegible] was awarded the Progress medal of the Royal [illegible]tographic Society of Great Britain the Elliott Cres[illegible] medal of the Franklin Institute and a special gold [illegible] from the Photographic Society of Philadelphia

We are informed that a company in this city under the style of Ives Inventions is soon to introduce this latest system which seems to be of a very practical character

WIRELESS TIME SIGNALING TO SEA FROM THE EIFFEL TOWER

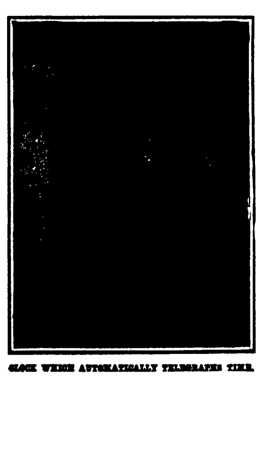
BY F HONORE



The wireless telegraphic station of the Eiffel Tower is now signaling Paris Observatory time to all vessels within a radius of 1 800 miles The present station is using 15 to 16 horse-power When the new installation whose completion was delayed by the recent floods is finished 100 horse power will be at the disposal of the engineers and the range will be doubled

A master clock which has long been used for the correction of marine chronometers is set up in a room of the observatory side by side with clocks that telegraph mean time to various centers in Paris and sidereal clocks which serve to regulate this mean time The master clock in question itself indicates mean time with reference to the meridian of Paris Inclosed in a glass case and suspended from a wall so thick that vibrations in masonry and variations in temperature cannot affect the mechanism it is corrected each day if necessary by means of a magnetic regulator The rod of the pendulum carries a magnet the lower end of which is spaced a few millimeters from a solenoid Depending upon the direction of the current which is sent through the solenoid, the magnet is attracted or repelled thus retarding or accelerating the beat of the pendulum In this manner a lost second is regained in thirty-six minutes

The clock is connected by wires with the key of the wireless station of the Eiffel Tower At midnight at [illegible], and at 12 04, the clockwork automatically



CLOCK WHICH AUTOMATICALLY TELEGRAPHS TIME.

completes a circuit, thus actuating a Morse key and causing Hertzian waves to be emitted

The observatory itself is not equipped to send wireless signals but it receives th m by means of a small aerial connected with telephonic receivers On the other hand by means of a Morse key in the circuit of an ordinary telegraph syste n independent of the clock the wireless apparatus on the Eiffel Tower can be operated from th obs rvatory

At the proper time each day an official dons a telephone headpiece and proceeds to the work of notifying vessels at sea of the correct time One finger on the Morse key his eye glued to the end of a reading telescope the official watches the beat of the pendulum At 11 59 he depresses the key and by means of agreed signals he attracts the attention of vessels in the range f a ti n At midnight the clock automatically signals the h ur This transmission of time is re p at 1 twice as we have said namely at 12 02 and at 12 4 preceded y other combinations of warning signals Hence vessels receive the time thrice in five n ut s

The officer on board the vessel at sea is similarly equipped with a telephone headpiece and he watches a hro ometer instead of a clock Making due allowance for possible errors of observation he estimates the error of his chronometer

Esperanto and Ido

In last week s S PPLEM AMERICAN SUPPLEMENT we hro icl d the fact that a new international language has made its appearance which is a strictly scientific attempt made by an international commission of philosophers scientists and philologists to improve Esperanto and to provide the world with an artificial language which shall be tr ly international Some of our Esperantist friends have misunderstood the purpose of the commission and do not fully realize the scope of the improvement which has been effected They have written rather heated protests against the article which we published We are neither Esperantists nor Idoists but it seems to us that a fair examination of the International Commission s work must convince anyone of the valuable service which it rendered Below we republish Prof O Jespersen's [illegible] of the limitations of Esperanto taken from a [illegible] book published by the Délégation pour l'[illegible] d 1 e ang e aux iliaire internationale

Dr Zamenhof has given us an interesting [illegible] of the way in which his language gradually [illegible] in his mind while he was at the Warsaw G[illegible] Before he arrived at the conviction that the [illegible] f r the vocab lary must be obtained from the [illegible] and Germanic languages, and that the already [illegible] ing stock of international words must be used, [illegible] simply invented his words that is to say [illegible] them it arb t ar ly but with as much [illegible] system and brevity as possible Although h[illegible] noticed that such words are difficult to learn [illegible] more difficult to remember he has unfortu[illegible] tained in the finished language a whole series [illegible] *a priori* formations which appear in words [illegible] frequent occurrence as who how where [illegible] everywhere etc The *nul tempe* and *pro* etc chosen by the Delegation agree however m ch better with the general character of language than the *neniam* and *kial* of Dr Zamenhof

Some peculiarities may be accounted for by the Slavonic mother tongue of the author for example his preference for sibilants and diphthongs which is especially evident in the invented words (e g *ĉi* here *ĉiu* each *eĉ* even *ĝis* that *ĝis* until *ĝh* and *h* being pronounced as E j and *ch*) In an article in Zamenhof s Krestomatio I find for example (p 288) *kiuj tiuj senantaŭjuĝhaj kaj honestaj homoj kiuj anstataŭ filozofadi pri ĝi* and (p 298) *tiun ĉi ankoraŭ ĉi tiu la apero de la unua arta lingvo antaŭ e dis kaj antaŭdiris ĉiuj tiuj eminentaj homoj kiuj* etc The method of writing x is also Russian *ekzameni ekzemplo* etc and also *ekspedi eksplodi* also *kv* for *qu* French words with *oi* take *oa* in Esperanto when they are spelt in this way in Russian e g *trotuaro tualeto voalo* otherwise they are spelt with *oi* or *oj* e g *foiro fojo foino* Nacio tradicio etc instead of -iono is also Russian Russian usage has do ibtless also inspired such word formations as *elparoli* and *senkulpigi* instead of the international *pronunciar* and *exkyar* (Russian *vygovarivat* and *izvinat* corresponding to German *aussprechen* and *entschuldigen*) The peculiarity of using the adverb instead of the adjective in such cases as *estas necese vidi* it is necessary to see is probably to be ascribed to the correspondence of the Russian adverb with the neuter predicate adjective This rule cannot be permitted however in an international language because with a free word order it would be impossible to say whether *estas vere necese* means it is really necessary or 'it is necessarily true The compound perfect (*mi estas aminta*, I have loved = I am having love) reminds one of the Polish kochal-em. Finally the frequent use of the adjective (in -a) instead of the genitive (*Zamenhofa lingvo*) and of the two sorts of action expressed by *ek* and *ad* (*ekvidi* and *vidadi* used in many cases where the simple *vidi* would be sufficient) are to be accounted for by Russian usage.

"Naturally I do not object to the importation of national peculiarities into the international auxiliary language when the latter is enriched thereby For example one must make use of the facility for forming compound words common to the Germanic and Slavonic languages in preference to the poverty of Romance languages in this respect and combine it with the more Romance characteristic of forming new words by means of derivative syllables. But peculiarities of national language which render mutual comprehension and international usage difficult must be most carefully avoided.

The unpractical nature of the circumflexed letters has been indicated It may be remarked here however that in point of system Zamenhof s letters are very inferior to the similar ones employed in the Czech language since the parallelism in sound between *s* and *ŝ* *z* and *ĵ* *dz* and *ĝ* is disguised by the choice of letters This produces a very amateurish effect.

Beside the familiar parts of speech which are indicated by special terminations Zamenhof invented a new class characterized by the termination -*aŭ* (*hodiaŭ almenaŭ*) but the limits of this class which includes some but not all adverbs and prepositions are not clearly defined

Many words taken from existing languages are disguised almost after the fashion of Volapük *boji* French *aboyer* *parkere* French *par cœur* *ŝ ŝvit* German *schwitzen* English *sweat* char French *cor furuno* instead of *furin lerta*, French *alerte* (with a changed meaning) etc In this category is to be classed the astonishing *nepre* (entirely) which is derived from the Russian *nepremenno* just as if one were to take from the German word *unbedingt* the first two syllables and propose *unbe* as an international word instead of *absolute* The economy in the use of stems was carried much too far in Esperanto necessitating the employment of all sorts of compound words the discovery of whose meaning requires [illegible] The employ[illegible] [illegible] as independ[illegible] [illegible] a very [illegible] [illegible]tly wanting [illegible]rect deriva[illegible] [illegible]learly indi[illegible] [illegible] out from [illegible] to mean [illegible] so that [illegible] whereas [illegible] must [illegible] if a king [illegible] most important [illegible] which formed [illegible] Committee The [illegible] not prevent me [illegible]rvices of Zamen[illegible] [illegible]tion of the best construction of an international language was not seriously discussed succeeded in producing one which was in many respects superior to the attempts of that time and which has proved in practice a serviceable though very imperfect means of international communication

The Government and the Inventor

We recently commented upon a bill which is being considered by the House of Representatives, the purpose of which is to compensate those inventors whose inventions have been appropriated by the government. Since the publication of our remarks further testimony has been taken before the Committee on Patents, which reveals the hardships of an inventor who endeavors to create something which will be of benefit to his Government which only the Government can use and for which he has only one customer and that is the Government itself

One such invention is a torpedo system with a trolley guide which was conceived by Mr William S. Brewster while he was associated with Mr Edison It was at the time Mr Edison and Gardner Sims were perfecting the Edison Sims torpedo. Mr Brewster thought that instead of guiding the torpedo to its destination by its own mechanism, it could be guided by a trolley system He consulted Generals Newton and Abbot who were then prominent engineers in New York, about the system but he never took any patent out until advised to do so by a prominent officer in the War Department In 1896 he applied for a patent, which was issued in 1897 and which was offered to the War Department at practically the Department s own terms. The patent was granted for an invention which Mr Brewster could not use himself and which the Government might use if it found it serviceable. The offer was declined. [illegible] time of the Spanish war the invention [illegible] offered to the Government, with the [illegible] that [illegible] [illegible] years [illegible] [illegible] ment was [illegible] of Fortress Monroe, [illegible] note the effect [illegible] before the [illegible] Mr Brewster wrote to the Navy Department [illegible] closed a copy of his patent and a bill for the use of his patented trolley system in this torpedo test at Hampton Roads, In so far as the Government [illegible] his trolley to guide the torpedo so that it should strike the target, Mr Brewster thought that it appropriated his invention One of Mr. Brewster s claims reads

In a submarine torpedo system, a submerged cable constructed and adapted to constitute a track for guiding and controlling a torpedo in transit, and a torpedo connected thereto substantially as set forth.

This is so broad that the Government obviously infringed

The trolley system has since been used in testing the Davis torpedo gun Mr Brewster wrote again to the Navy Department asking for compensation for the use of his invention The Navy Department replied that the Electric Boat Company was making the tests of the Davis torpedo although as a matter of fact, the contests were actually conducted by officers of the navy Lieut. Commander Davis acknowledged the use of the guide saying that he did not know of the patent. Further correspondence with the Navy Department led to a controversy on the scope of the patent and the price demanded and finally ended in a flat refusal to pay

Another shining example is to be found in the utilization by the Government of Prof. R A. Fessenden s improvements in wireless communication Prof Fessenden was employed for about a year in the Weather Bureau One or two of his early inventions were produced during his employment but all of his later ones have been produced since Some of his patents have been the subject matter of suits in the Circuit Court of the United States and have been sustained. Infringements of them have been enjoined. The unsuccessful defendant in one suit tendered infringing wireless material to the Navy Department Prof Fessenden protested against the Navy Department s purchasing the material from the infringer calling its attention to the fact that a court of the United States had enjoined it from furnishing such material The Department replied rather autocratically that however that might be it preferred to purchase material in the cheapest market and leave it to the patentee and infringer to work out their salvation as best they could The infringer proceeded to furnish the material contracted for and delivered it to the Navy Department. The furnishing of that material was used as the basis for contempt proceedings. The officers of the infringing company were committed for contempt of court and were fined

There is now pending in the Supreme Court on writ of certiorari a case brought in the local court by the Krupp Company against General Crozier Chief of Ordnance in which it asks for an injunction to restrain him and his subordinates from making guns for the army according to the Krupp patent When the case came up for decision in the Court of Appeals of the District of Columbia the Court held that regardless of the fact that General Crozier was an officer of the United States army he derived no personal benefit from the use of the Krupp patents nevertheless he was an infringer The Krupp Company asked only for an injunction in this case and not for any compensation for the use made of its patent prior to the final decree An injunction pure and simple would not be a complete remedy in many cases General Crozier was merely the agent of the Ordnance Department. The Government of the United States derived the benefit and not he from the use of the Krupp inventions But that situation does not absolve the Government from paying.

Very often patents are being infringed by the Government without the knowledge of the patentee, because not every one can walk into a naval gun shop and see what is going on. Machines may be used in the Post Office for years without the fact being discovered A man may invent a new brand of [illegible] gum or a [illegible] He may invent a [illegible] gun or gun carriage or a new style of armor, or a [illegible] in the Post Office that would save a great deal of money [illegible] and get nothing at all for [illegible] at the caprice or whim of [illegible]

So hard have [illegible] be admitted that the [illegible] United States [illegible] shown every [illegible] as they could. [illegible] the case of [illegible] back to [illegible] stated that [illegible] the award [illegible] [illegible]

[illegible] or consideration. Yet the Government ignores [illegible] and refuses to pay

[illegible] such actions as inventors have succeeded in maintaining against the United States have been largely based upon implied contracts. Thus in Burns's case (12 Wall, 246) it was held that the offer of the Government to use a patented invention was a valid consideration to support an action on an express contract for royalty. At first sight it might seem as if patentees already have protection in the remedy which they now have in the Court of Claims for the infringement of their rights by the Government. The courts have however found a difficulty standing in the way of granting to inventors a right to damages against the Government in cases where their patents have been used, in the fact that the statutes defining the jurisdiction of the Court of Claims confine it as a rule to cases arising upon contract with the Government. Hence the necessity of bringing actions under contracts implied or expressed. Thus, in the case of Palmer (128 U S 262) the patentee invited the Government to adopt his invention and the Government did so. This was held to amount to an implied contract. In the case of the Berdan Fire Arms Company (156 U S, 552) the patentee communicated his invention to the officers of the Government and they used it without expressly repudiating his title. These facts were held to give rise to the implication of a contract. The line is so slight as to be little more than fortuitous and the distinction is one that is utterly unworthy of a great government desiring to do impartial justice to all citizens.

New Trade Mark Bills

As the trade mark law now stands the registration by a corporation of a technical trade mark which may be its whole name or part of its name is impossible. The Court of Appeals has held in a recent decision published in the Official Gazette of July 7th 1908 in the case of Kentucky Distilleries and Warehouse Company vs Old Lexington Club Distilling Company that where the applicant is a corporation a trade name which is substantially a reproduction of the corporate name cannot be registered as a technical trade mark. That decision was regarded by the Patent Office as authority for making further decisions which are generally known in the profession as the decision in the case of the Champion Safety Lock Company the Amulet Chemical Company the Union Carbide Company and the Success Company.

The situation is anomalous. The Champion Safety Lock Company could not register its trade mark Champion under the law as it now stands or as it is now interpreted by the Court of Appeals because the word Champion is a conspicuous or salient part of the name of the company while John Smith who has no rights whatever with regard to the Champion mark may register the trade mark. Obviously this is unjust. A bill has been introduced for the express purpose of authorizing the Patent Office to grant such marks and to follow the letter of the law.

In cases such as the Union Carbide Company case there is, however another element which must be considered. In this case the word Union may be regarded as geographical and Carbide of course as descriptive so that possibly this is a case where the trade mark should not be registered unless it came under the ten year clause of the law. But Success and "Champion and Amulet and such are obviously valid technical trade marks.

Another instance can be found in the word Kodak as applied to photographic cameras. That word is undoubtedly a good trade mark. It has been sustained by courts of this country and courts abroad. Yet it is ineligible to registration because the company that exploits the manufacture of that particular thing and has the ownership of that mark has come to be called the Eastman Kodak Company. It seems unfair that a trade mark which is a good mark should be unregistrable because it happens to be incorporated in the firm name or the corporate name of its owner.

The Committee on Patents of the House of Representatives has also before it for consideration measures which have for their purpose the increasing or facilitating of remedies for trade mark infringement, [illegible] the Patent Office to keep a more complete [illegible] of trade mark claims or rights.

The change proposed in one of the bills permits the registration of non-technical marks if it can be alleged in the application that to the best of applicant's knowledge and belief the marks have been used for ten years prior to the filing of the application. The [illegible]

Correspondence.

DISTILLING LICENSES

To the Editor of the SCIENTIFIC AMERICAN

I have seen in one of your SCIENTIFIC AMERICAN publications an article concerning Manufacturing Perfumes at Home. You recommend a still for the distillation of flowers also illustrate such a still. I wish to call your attention to the fact that such still must be registered with the collector of the district in which such still is located not only before operation begins but immediately after the still comes into the possession or custody of such person whether it be a new still distillery apparatus or not.

The law requires all stills set up to be registered if for use or not. This applies to all stills of what ever size and for whatever purpose intended. Any still which is not registered is subject to forfeiture to the United States together with all personal property in the possession or custody or under the control of such person and found in the building or in any yard or inclosure connected with the building in which the same may be set up. The person whose duty it is to register any still failing to do so is subject to fine and imprisonment under section 3258 Revised Statutes (Internal Revenue Department).

Kindly bring this to the attention of your subscribers to avoid any difficulties.

Newark N J H H FREUND

RAISING THE MAINE

To the Editor of the SCIENTIFIC AMERICAN

The recent act of Congress authorizing the raising of the wreck of the U S S Maine has given rise to many suggestions for raising her. The wreck has rested on the bottom of Havana harbor for nearly twelve years, and has doubtless settled considerably in the mud. The Maine was destroyed by the explosion of a submarine mine which caused the partial explosion of two or more of the forward magazines. Apart from the loss of life the results of this explosion were that the vessel from the bow to frame 41 was terribly [illegible]

Therefore it [illegible] frame 41 aft is [illegible] doubtful if anyth[illegible] tered forecastle [illegible] stroyed by dyna[illegible]

A new bow [illegible] which could be [illegible] similar thing [illegible] White Star line[illegible] lish coast. Her [illegible] which was held [illegible] under her own [illegible] docked. A new [illegible] fast, towed to [illegible] Within a year [illegible] regular duties [illegible] tralian steamers.

Brooklyn N Y [illegible]

HOW LARGE DOES THE SUN APPEAR TO ME?

To the Editor of the SCIENTIFIC AMERICAN

Ask ten people how large the sun looks to them when it is in mid heaven and you will get ten different opinions of its size which range from a silver dollar to a cart wheel. The varied opinions are due to the fact that there is nothing with which to compare it when looked at by itself. Before any accurate estimate of its size can be made we must have some known object with which to compare it.

Thus when the sun is on the horizon and appears to be close to houses trees and hills it looks very large. To some people it seems as large as a house or tree. Moreover there are more persons who will agree that it appears to be a certain fixed size under this condition than will agree when it is viewed at the zenith. The diversity of opinion in the latter case results from the inability of the eye to size up an isolated object.

This has been proved by projecting a narrow beam of light on a perfectly black non reflecting screen so placed that the observer could see nothing but the beam of light and had no way of judging his distance from the screen. The observations of several people under these conditions revealed the fact that there was no certainty about the length of the beam the apparent length being estimated all the way from a few inches to several feet.

This being the case when the sun is in mid heaven how can its size be reduced to some uniform standard?

The most logical answer is found by representing it as a circle located at a fixed distance from the eye.

The average reader holds the printed page about one foot from his eyes when reading. At this distance he can estimate fairly closely the size of the type or an illustration. In fact, a dozen good judges of dimensions can tell the size of an illustration, that does not exceed a few inches, within a small fraction of an inch. These same men if asked to draw a circle on the sheet that would just cover the sun's disk if held between them and the sun at a distance of one foot from the eye would produce a series of circles of magnitudes ranging from a twenty five cent piece to a saucer.

The real size of the circle should be only three sixteenths of an inch in diameter.

The method of representing the sun's exact size by a circle one foot from the eye is simple. Take a smoked glass hold it one foot from the eye and scratch pin marks tangent to the sun's disk at the four quarters. When the diameter of the circle inclosed within these marks is measured it will be found to be very close to three-sixteenths of an inch.

In other words if a circle of this size were drawn and in its area were reproduced in proportion to an average sun spot the observer would be able to examine the small dot at a distance of one foot from his eye with just about the same ease that he could examine the real spot on the sun through a smoked glass. Or again if the moon which is the same apparent size as the sun and whose disk can be represented by the same small circle were to be reproduced in miniature within its area an observer holding it one foot from his eye could examine it with the same scrutiny that he could examine the full moon with his naked eye.

Detroit Mich E C LANDIS

The Current Supplement

The British Antarctic expedition has started on its journey for the South. Consequently the opening article of the current SUPPLEMENT No 1798 in which the equipment of the expedition is described will prove of interest. Not so many years ago in his famous book on education Herbert Spencer put forth a powerful plea for the study of science. Nowadays how ever an advocacy of that kind is not called for and his book is at present largely of historic value only. Since that time the pendulum has been swinging too far toward the scientific. Prof Albert G Keller in an article on Science and the Humanities argues for the inevitableness of the humanities and of humanity. He asserts not only that our lives may be enriched by the pursuit of culture in diverse forms not only that our destinies must be impoverished by the renunciation of all lines save one but also insists upon the more concrete contention that our special scientific work is bound to suffer as a consequence of the neglect [illegible] for which the humanities stand. In all parts [of] the civilized world the least [illegible] [the] population from a physical and mental [illegible] and [illegible] is producing more numerous progeny and [illegible] would seem that unless means can be devised to stay this flood of the unfit *in the course of time the entire race* must descend to a lower level as regards physical and mental qualities. Of late the aid of eugenics and more recently still that of Mendelism has been invoked to keep the race at a high standard. The methods adopted are outlined in an article entitled Eugenics and Mendelism. Mr Paul F Bauder writes instructively on the quality of light. A sympathetic and appreciative biography is published of the late Sir William Huggins. Elihu Thomson contributes a thoughtful paper on atmospheric electricity. One of the most interesting problems of archæology has been solved by the recent excavations at Alesia that ancient city of Gaul where Vercingetorix headed 80 000 of his countrymen in a last gallant though futile attempt to stem the advance of the victorious legions of Cæsar. The wonders of these excavations are told in an interesting article. Mr Leon A Hackett contributes a very exhaustive paper on the processes of cotton spinning.

The removal of ashes by conveying them to a waste bank hydraulically is done in connection with the temporary plant built to supply power during the construction of the Rainbow Falls hydro-electric development of the Great Falls Water Power and Townsite Company on the Missouri River near Great Falls Mont. The power house is [on] the side of a hill directly above the edge of the river bank. The bituminous coal used is dumped by gravity from cars on a trestle to a bin at the rear of the firing floor of the boiler room and runs down on this floor from which it is fed by hand to the furnaces. As the ashes fall through the grates they are drawn out into a transverse concrete-lined trench in the firing floor. This trench is sloped to one side of the building where it connects with a flume extending on a grade of about five per cent to the edge of the river bank. When the grates are cleaned the ashes are pulled into the trench and a hose stream turned into the latter to start them. They are thus picked up by and carried out to the river through the flume only a small amount of water being required. No difficulty is experienced from clogging in the trench or flume and the current in the river prevents an accumulation at the edge of the bank.

A GARDEN OF FUNGI

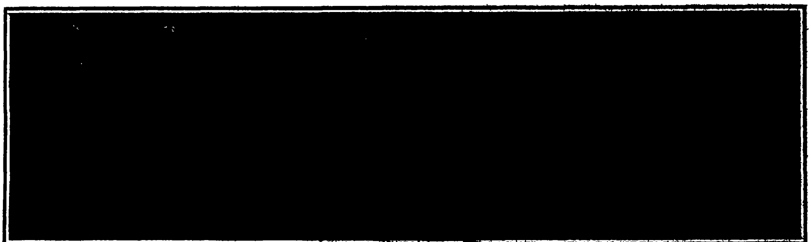
BY JACQUES BOYER

The Mycothèque annexed to the laboratory of cryptogamy of the Paris school of pharmacy is unquestionably the most original garden in the world It contains living specimens of 107 species of molds and allied fungi which M Bainier has patiently collected separated and cultivated on an appropriate medium

The fungi are sown or planted on pieces of licorice root in bottles of Bohemian glass about 3 inches in diameter and 8 inches high The mouth of the bottle is closed with a plug of cotton wool A glass rod the top of which is enlarged to form a cup in which the pieces of licorice root are placed passes through an India rubber stopper which is fitted to a hole in the bottom of the bottle The miniature greenhouse rests on a base of wood or porcelain filaments of *Penicillium* at first simple and later branched and resembling a brush bear chaplets of green gray yellow or rose-colored spores Minute drops of water often condense on the brush of *Penicillium claviforme* producing a very beautiful effect.

In order to obtain a pure and isolated species in each bottle interlopers of other species are carefully removed and the bottle if necessary is replanted two or three times The principal function of the collection is to supply the laboratory with living specimens of assured purity of type for use in research and in the illustration of lectures

The position of the curator is no sinecure When the nutrient material has been exhausted the fungus will perish unless special methods of preserving its life are adopted M Bainier having learned by experience number of European species, which likewise possess the two-fold power of transforming starch into glucose and of converting glucose into alcohol and carbon dioxide Among these species is *Mucor racemosus*, which is frequently seen growing on decaying vegetable matter *Phycomyces splendens* exhibits delicate filaments terminating in little balls. An allied species, *P nitens*, is employed to heighten the brilliancy of carmine by consuming the fatty ingredients of cochineal The single genus *Penicillium* is represented by 17 species. *P glaucum* is the common green mold which attacks bread, fruit and other articles of food Various sorts of cheese owe their characteristic flavors to species of *Penicillium* Brie and Camembert to *P candidum* and *P album*, and Roquefort to *P virescens* which develops inside the cheese and produces the characteristic green veins



Penicillium claviforme — *Penicillium candidum* of Brie cheese — *Sterygmatocystis nigra.* — [illegible] — *Fusarium* or melon fungus — *Aspergillus* [illegible] — *Phycomyces splendens.*

[illegible] JARS.

The licorice roots are deprived of their cork like bark in order to lay bare the yellow alburnum or [illegible] wood which is filled with glycyrrhizin a sacchari[illegible] substance which is very favorable to the developme[illegible] of mold fungi

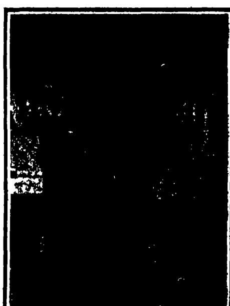
Before the mold spores are sown the bottles conta[illegible]ing the pieces of licorice root are sterilized by heati[illegible] them to 248 deg. F for one hour in an autoclave [illegible] One of the accompanying photographs shows [illegible] Bainier [illegible]ing the spores by removing the cotton plu[illegible] and depositing a few spores on the licorice root [illegible] means of a platinum wire sheathed in a glass r[illegible] The platinum wire is sterilized by passing it throu[illegible] the flame of a Bunsen burner before it is dipped i[illegible] the mold culture and the cotton plug is instantly re[illegible]placed after the sowing The bottle is then placed in one of the cases in the Mycothèque where the mycelium of the fungus rapidly permeates the licorice root which becomes covered with a growth which varies greatly in appearance according to the species

Syncephalastrum develops a dense mass of long grayish hairs *Isaria felina* resembles a shrub with many branches and *Acrostalagmus roseus* presents the appearance of a white felt hat The reproductive [illegible] spores of each [illegible], arranges his [illegible] week one or [illegible] of cryptogams [illegible] retain their [illegible]hile others die [illegible]ure has led to [illegible]blished descrip[illegible] fact that the [illegible] separated from [illegible] organs of one [illegible] most interesting [illegible]. Among the 27 [illegible] we observe *Mucor mucedo*, the common brown mold which attacks many substances and especially infests horse dung *Chlamydomucor orisae* and *Rhizopus orisae* which are used in the Orient in the production of fermented liquors from rice *Amylomyces Rouxii* or Chinese yeast which is used for the same purpose by the Chinese and was introduced into Europe by Dr Calmette director of the Pasteur Institute at Lille and a

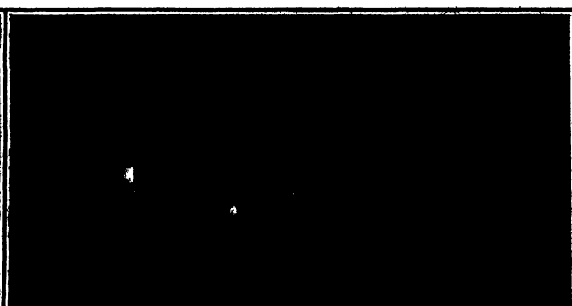
The genus *Aspergillus* is represented by 6 species *A orisae* is used in Japan in the fermentation of the national beverage sake or rice beer *A fumigatus* attacks the mucous surfaces of the respiratory organs of birds and produces a pseudo-tuberculosis in pigeons fattened by the cramming process. There are 15 species of *Sterygmatocystis* including the celebrated *S nigi* (also called *Aspergillus niger*) which was studied so minutely by Raulin

The collection also contains various fungi which are parasitic upon insects including *Cordiceps* which infests caterpillars and *Botrytis* of which one species causes the muscarine disease of silkworms and others have been employed to destroy May beetles and locusts.

Alfred M Angot director of the meteorological service of France has reported to the Academy of Sciences that no exceptional variations in terrestrial magnetism or atmospheric electricity were observed in the neighborhood of Paris during the night of May 18th 19th when Halley's comet was in transit. The meteorological observations also failed to indicate any disturbance that could be attributed to the comet.



Sterilizing the bottles.



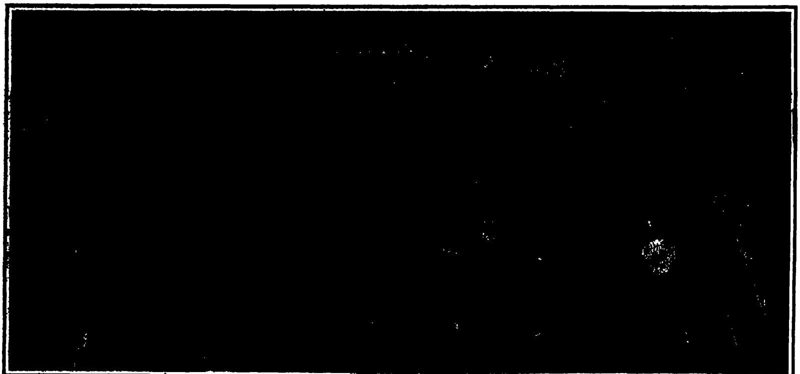
Planting the fungi.

A GARDEN OF FUNGI.

THE TEMPERATURE OF THE STARS

BY JOSEPH BARTON

By means of his heterochrome stellar photometer M Charles Nordmann has succeeded in obtaining in addition to other interesting results measurements of the effective temperatures of certain stars The apparatus consists of a lateral attachment to the eye-piece of an equatorial telescope and like the Zollner photometer it allows the focal image of the star to be placed in juxtaposition to that of an artificial



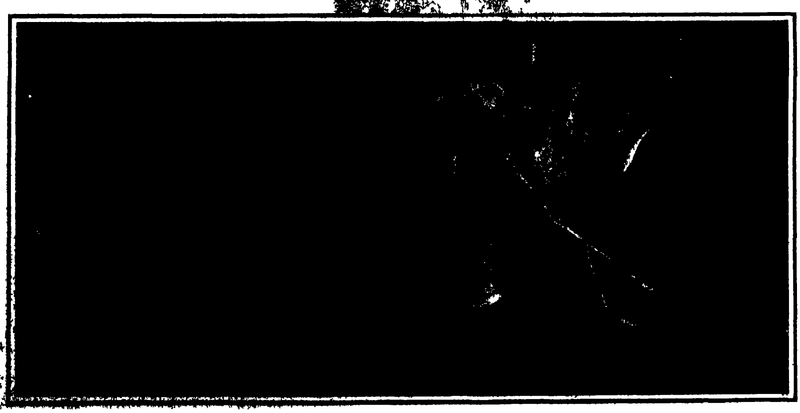
Nordmann's heterochrome stellar photometer [illegible] of the Paris Observatory

star This part of the apparatus contains two Nicol prisms the third Nicol and the quartz plate of Zollner s photometer being suppressed Furthermore between the focus and the eyepiece in the common path of the rays of the real and the artificial star is placed a sliding drum which carries interchangeable cells filled with colored liquids In this manner a series of mono-chromatic images of the real and artificial stars can be produced The photometric measurement is made by rendering the images of the two stars equally bright by turning the two Nicol prisms which are interposed in the path of the rays from the artificial star and are provided with graduated circles

The artificial star which performs the function of a secondary standard is obtained by converging upon a circular aperture the light of an Osram metallic filament lamp of four volts and one ampere This little lamp is operated by storage batteries and regulated by means of a rheostat and an accurate voltmeter There is no difficulty in maintaining the differences of potential between the lamp terminals constant to within 1/100 volt by adjusting the rheostat once or twice per hour This corresponds to an in appreciable v[illegible] star The gl[illegible] line dyes N[illegible] solutions wh[illegible] spectrum [illegible] taining red [illegible] parallel glass [illegible] 1 5 inch Th[illegible] spectrum inc[illegible] 490 millionth[illegible] mits the part[illegible] red and th[illegible] tion of the [illegible]

The photo[illegible] upon the in[illegible] various temperatures between 2550 deg F and 6 00 deg F these temperatures being measur d with the Féry pyrometer The first determinations ma l with the small horizontal equatorial of the observatory of Paris and the photometer described abov showed that this method of monochromatic imag s gives in a simple manner the measurements and ratios of the total luminosity of stars free from the [illegible] tive errors inherent to the older processes It [illegible]its furthermore the solution of certain problems [illegible] physical astronomy especially the measurement [illegible] temperatur s of stars [illegible] d termination of [illegible]perature is based on [illegible] luminous bodies are of equal intensity in their [illegible]ddle portion but of very different intensity at their [illegible] remities the body whose spectrum is brightest in [illegible] blue region possesses the higher temperatur[illegible] [illegible]nce when the two spectra are compared with [illegible]ames of known temperatures the temperatures of [illegible] stars can be easily deduced from the optical obser[illegible]ations Nordmann finds for the temperature of the [illegible] the value of 3320 deg C (3608 deg F) This is

(Continued on page 511)



Standardizing the photometer with the aid of an electric furnace.

THE TEMPERATURE OF THE STARS

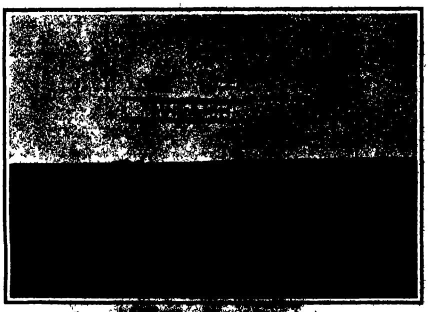
The Flights of Rolls, De Lesseps, and Curtiss Compared

BY CARL DIENSTBACH

The "heavier-than-air machine" during the past few weeks has proved nearly as useful as the large modern airship, that has already been commercialized. When Blériot first flew across the English Channel, aeroplane traffic seemed near. But as nobody, not even his rivals in that attempt, repeated the feat, his performance gradually lost its convincing quality. In Germany his feat was dubbed a "mere piece of good luck." When, however, during the last few weeks, the Channel was not only crossed again on a Blériot machine, but in quick succession the whole navigable length of the Hudson was covered in a splendid high-speed flight, and when on the heels of that triumph the Channel was crossed and recrossed in a single flight, everyone realized that the aeroplane had entered upon a wider field of useful ness and that it was indeed a vehicle which is destined to be the pleasure conveyance of the future. The three flights mentioned were all over established routes of the liveliest traffic. They all required a machine which would not fail, under penalty of falling into the water, and they were all between rocks or precipitous mountain sides, which made it a problem to land in case of emergency, and which influenced the air currents in a way as yet so little known that even a zephyr might become formidable. That they were successfully accomplished by machines of so widely different types as the Blériot monoplane and the Curtiss and Wright biplanes shows to what extent the technics of flying machine construction have advanced within the past year. They especially emphasize the immense progress that has been made with regard to the heart of an aeroplane—its motor.

It seems now certain that the aeroplane motor will merely repeat the history of the automobile engine. It offers certainly a more formidable problem, but it seems now assured that the continuous falling of the early flight motors was due less to the inherent difficulties under which they had to work—running almost continuously at top-load—than to inexperience of the makers. It should be pointed out that the Curtiss and a Blériot machine alike flew with half the power with which they were provided for these trips. They were not larger than the standard type but De Lesseps had a 50 horse-power Gnome motor in place of the 24 horse-power Anzani with which Blériot flew across, and Curtiss also a 50 horse-power eight-cylinder motor against the usual 25 horse-power four-cylinder engine of a Curtiss biplane. Capt. Rolls had made no attempt to double the motive power of his Wright machine, but as he was flying alone he had considerable reserve force at his disposal. These were all machines capable of carrying a passenger, but flying with only the pilot aboard. Consequently the motors were not running continuously under top-load any more than automobile motors. Count de Lesseps used his power sparingly. He made little better time than Blériot. Even Curtiss, who was beating the "Twentieth Century Limited," says he rarely opened the throttle wide.

There is another feature common to these flights, to which their success must be ascribed just as much as to more reliable motive power. It is the evolution of high flying. For trips of this nature a great elevation has the very obvious advantage of easy reckoning. De Lesseps flew in a fog, yet, in contrast to Blériot, he was almost always in sight of land, at an altitude of a thousand feet, as compared with Blériot's 300. From the same superior level Curtiss saw the scenery spread below him like a chart. He could make short cuts, pick his landings, and easily decide where best to lay his course. Flying high greatly simplifies the pilot's task, where low flying would add to the difficulties of balancing, the difficulty of following a more or less circuitous course while dodging obstacles. It means something like the strain on a bicycle rider, who with his eyes glued to a country road, tries unceasingly to pick out a path. Though a flying pilot does not fear actual contact with objects below there still remains the need of allowing for leeway in case of wind gusts, irregularities of the motor or swaying the machine. The principal advantage of being able to go high is, however, in the increased "range" it gives in dominating the air itself.



Rolls in his Wright [illegible] before crossing the Channel.

De Lesseps in his Blériot monoplane flying across the Channel.

THE SECOND AND THIRD AEROPLANES TO FLY ACROSS THE ENGLISH CHANNEL.

Aviators are fast realizing that it is better to [illegible] aerial disturbances than to fight them. This tends to prevent them from following any route that approaches the confined character of a roadway. The really favorable lanes of flight may be found only if the machine, unfettered, can pick its path at any level up to a thousand feet or more. The importance of flying very high across the Channel was understood by Latham, but not by Blériot, who ran into an aerial maelstrom when trying to land. De Lesseps and Rolls, who [illegible] crossed the very edge of the cliffs, being [illegible] above this trap, escaped all danger of being [illegible] the violent air-surf that beats against the [illegible] of these rocky walls not less [illegible] of the sea beats against their base. As the [illegible] was made in [illegible] some distance [illegible] beautiful [illegible] in France [illegible]

these tactics. Curtiss, flying along a deep cut river valley, with a narrow base, but much wider in its higher part and surrounded by high, irregularly grouped hills, densely wooded, wisely resorted to the very opposite maneuver of skimming the surface of the water. He had no doubt learned this trick while flying above Lake Keuka. The Hudson River is known as the "American Rhine," but the long narrow valley of Lake Keuka reminds one of the German Rhine still more strongly with its long rows of vineyards along its steep sides, and the massive masonry of the wine cellars vaguely suggesting the ruins of old castles. If weather conditions are similar to those of the bright Sunday when Curtiss made his epoch-making flight to New York, the greatest safety from the air's billows is indeed found next to the water in such a river valley.

As a feat of navigation Curtiss's flight excelled De Lesseps's and Rolls's journeys across the sea. He had to deal with much more varied conditions of the air, just as changing as the topography of the landscape over which he was passing. It is not surprising that on his long trip he encountered that bugbear of the aeroplane, descending currents, that was more familiar to aviators in the old days of the Lilienthal and Chanute-Herring gliding machines when the wind was rather sought than avoided. During the past few years of the power-driven machine, for good reason the reverse condition has been sought. Gliding in a calm is so uninteresting, the machine in "dead air" seems so inert and devoid of power, that Lilienthal, Pilcher, Herring, and Avery gladly preferred to risk the gusts instead. Curtiss only reiterates what Herring fourteen years ago so eloquently described, when he refers to a feeling at the pit of the stomach like that caused by a quick-starting elevator and to lightning changes in the level of flight of twenty to forty feet.

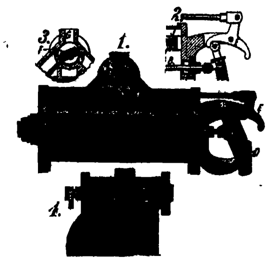
Curtiss's ingenious use of the horizontal rudder in meeting these disturbances by a "homoeopathic remedy," i. e., checking the descent by steering down and gaining speed, shows his great aptness for aeroplaning. In an interview with the author the Wright brothers indeed remarked as early as 1905, that to go up, it was at times necessary to steer down, but they did not publish such tricks of their trade. Modern aviators are rediscovering for themselves many a secret of the early "classics." Thus Mr. Curtiss is planning now to add a device which gives him a firmer hold on the machine at times, when under the impulse of descending air it is slipping faster away under him than gravity impels his own body, while in the original design of the same machine by Herring the method of handling the controls was such that the aviator could cling to it all the time just as firmly as to the first Herring glider, as adapted from Lilienthal. The method of supporting the body under the armpits was taken over in the [illegible] Chanute glider [illegible] adaptation and [illegible] of the Herring-Curtiss [illegible]

Curtiss [illegible] steering [illegible] Experiments [illegible] very [illegible] wheel [illegible] handling [illegible] simple [illegible] Curtiss [illegible]

Patent Department

AN IMPROVED WATER MOTOR.

Pictured in the accompanying engraving is an improved hydraulic motor of the type embodying a cylinder and reciprocating piston. The motor comprises simple means for reversing the position of the valve at the end of each stroke of the piston, so that the motor will operate continuously and automatically. Fig. 1 shows the cylinder partly broken away to show the piston and piston rod. It will be observed that the piston rod A is hollow to receive the valve rod B. The inner end of the valve rod is threaded to receive a pair of adjusting nuts, which are adapted to strike the end of the piston bore when the piston moves forward, thus forcing the valve rod outward. On the return stroke of the piston a plug C carried thereby strikes the nuts on the valve rod, and moves the latter to its inner position. The valve rod passes through the head of the cylinder and engages a rocker frame D, pivoted on a bracket formed on the cylinder head. This rocker frame consists of two crossheads connected by a pair of coil springs. The upper crosshead is formed with a roller, as shown in Fig. 2, which is adapted to engage a rocker E. The latter is connected by a rod and crank to a valve in the valve chest. The valve is shown in Figs. 3 and 4. It consists of a diametrically disposed plate F, provided with suitable packings, which may be turned to connect the inlet port G with either one of the passages H or J, while the other of the passages is connected with the exhaust port K. In operation, when the valve is turned



NOVEL WATER MOTOR.

to the position shown in Fig. 3, water will be admitted through the passage H to the left-hand side of the piston, forcing the latter toward the right and causing it, when it approaches the end of its stroke, to force the valve rod B outward. This will cause the rocker frame to swing out, making the roller carried thereby bear on the rocker arm E, and thus turn the valve F, so as to connect the port J with the inlet G and the passage H with the outlet port K. The springs on the rocker frame will cause the rocker arm to maintain its position until the valve rod B is acted upon by the plug C to return the parts to the position shown in Fig. 2. The inventor of this water motor is Mr John N. Hardy, of 411 West Second Avenue, Columbus, Ohio.

STOVE PIPE AND THIMBLE.

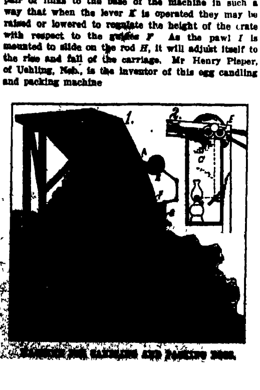
A patent has just been issued on an improved type of thimble for use in flue openings. The thimble is so constructed as to be firmly attached to the chimney, and is provided with projections adapted to engage slots in the stove pipe, so as to fasten the latter securely in place, rendering the joint proof against leakage of smoke or gases of combustion. The thimble is preferably tapered, as indicated in the drawing at A. Between the thimble and the flue opening is a space which is filled with any suitable cement B, that will attach the thimble firmly to the chimney and act as a heat insulator to prevent transmission of heat from the thimble to any surrounding woodwork. The thimble is formed with projecting ears C, which [illegible] E. At each end of the [illegible] removed whenever desired by turning it before withdrawing it from the thimble. A slight modification of this fastening device consists in attaching the thimble to the chimney by means of spikes F, which take the place of the ears C as well as the ear J. The stove pipe is provided with tongues which are undercut, forming grooves in which the spikes are received when the pipe is given a partial turn. The

IMPROVED STOVE PIPE AND THIMBLE FOR FLUE OPENINGS.

pipe is formed with a bead adapted to engage the flange B, which forms a neat closure in case the pipe does not perfectly fit the thimble. When the pipe is withdrawn, the opening may be closed by means of a cap G, which is provided with grooves H, like those of the stove pipe. The inventor of this stove pipe and thimble is Mr. Ambrose P McGuirk, of Davenport, Iowa.

EGG CANDLING AND PACKING MACHINE.

A machine for [illegible] automatically [illegible] is descr[illegible] to slide [illegible] A and B [illegible] away to [illegible] to drop th[illegible] of bridgi[illegible] shaped as [illegible] eggs, and [illegible] is a lamp [illegible] upward thr[illegible] amined. Th[illegible] be rotated, [illegible] a pedal D. [illegible] of fingers, [illegible] the sockets [illegible] to slide dow[illegible] ing fingers [illegible] the eggs at [illegible] are connecte[illegible] erated to rel[illegible] pedal D is [illegible] drop into the egg crate. The [illegible] B is connected to a pair of bell cranks, which in turn are connected by parallel rods H. Mounted to slide vertically on the rod H is a pawl I, which engages a rack on the carriage that supports the egg case, so that the carriage is moved forward at each operation of the pedal D to bring the crate into position for a new row of eggs. The carriage slides on tracks J, which are connected by means of a pair of links to the base of the machine in such a way that when the lever K is operated they may be raised or lowered to regulate the height of the crate with respect to the guides F. As the pawl I is mounted to slide on the rod H, it will adjust itself to the rise and fall of the carriage. Mr Henry Pieper, of Uehling, Neb., is the inventor of this egg candling and packing machine.



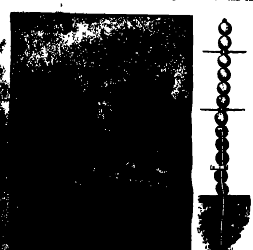
[illegible] CANDLING AND PACKING MACH.

NOVEL CONCRETE FENCE POST

A fence post of concrete blocks which is of a decidedly unique type is illustrated in the accompanying engraving. It consists of a series of blocks of concrete devoid of sharp angles and preferably of spherical form. These are mounted one above the other on a rod which extends through openings in the spheres. The post thus has the appearance of a set of huge beads strung on a giant pin. At suitable intervals a bracket is attached to the rod, to which the fence wires are secured. These brackets are of very simple form, consisting of U-shaped straps of metal, which are clamped to the rod by means of a bolt. One of the legs of the U member is extended beyond the other, and is formed with an opening through which the fence wire is passed. Any number of these brackets may be arranged on the rod intermediate of the spheres. It is claimed for this fence post that it is particularly adapted for cattle lands because its flexibility prevents it from being knocked down, and the danger of the wires being broken is thus greatly lessened. As the blocks are spherical, they are less easily injured by frost or weather conditions. The fence post may easily be taken apart and packed in a small space for shipping. The inventor of this fence post is Mr Charles T Howell, of Glen Flora, Wis.

Brief Notes on New Inventions.

The presence of a submarine boat is sometimes made known to the enemy by the train of bubbles that rise to the surface of the water from the gas-engine exhaust. These bubbles are readily discernible, and indicate the course which is being pursued, thus enabling the enemy to take measures for defense or a counter attack. In order to prevent a submarine boat from betraying its course in this way, an inventor has devised a method of retaining the exhaust gases, permitting them to escape only at irregular intervals in



UNIQUE CONCRETE FENCE POST

large quantities. Although the single large gas bubble thus produced would indicate the position of the submarine, it would not give any information as to the direction in which it was traveling or its rate of speed. The exhaust gases of the engine are led to a gas purifier and cooler, and then enriched with oxygen and passed through the engine again, so that the engine works in a closed cycle. An automatic valve serves to carry out the gases, when they reach too high a pressure, and conduct them to a receptacle, whence they may be released by a hand-operated valve when ever desired.

In case of fire, so the time-honored directions run, throw a mattress out the window and then jump down on it. As a mattress may not always be handy, an inventor of this city proposes that fire companies be equipped with mattress trucks for the accommodation of those who have been trapped in a burning building. He has invented a truck provided with a platform which carries a series of bed springs and mattresses and which, when brought to the scene of the fire, may be elevated to a considerable height, say to the second-story windows, and moved inward toward the building so as to bridge over the areaway. The inmates can then leap from their windows to the mattress.

There is nothing a fireman dreads more than a fire which produces volumes of dense smoke, for it is impossible for him to get near enough to the seat of the fire and to see clearly enough to direct the stream of water properly. Various devices to enable a fireman to breathe in such conditions have been proposed from time to time. A novel scheme of this sort has just been patented. It consists of a pair of bellows connected to a water wheel in the hose near the hydrant, and operated thereby to open and close alternately. Fresh air is thus pumped through an auxiliary pipe conducted along the main hose to a mask which is worn by the fireman.

In the raising of such vegetables as asparagus, green onions, pie plant, strawberries, and the like, it

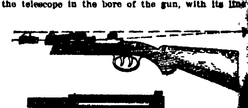
is customary to force the growth by covering the beds with glass. This is rather a cumbersome process, as it involves the construction of frames over the plants, which must be dismantled before they can be removed to a new location Furthermore, the heating device that is sometimes employed must be moved as well, which is rather an expensive operation. An improvement on these conditions has been suggested recently It consists in the use of a portable greenhouse and a separate portable heating plant, which may be connected to the heating pipes of the greenhouse The greenhouse is mounted on wheels, which travel on tracks or ways. The ways are temporarily laid when moving the greenhouse from one place to another

Two interesting patents on drinking cups have recently been issued One of them provides a folding-pocket drinking cup, which consists of a piece of flexible waterproof material folded upon itself to form a cup without any seams through which the water may leak The cup is covered by a strip of leather, and may be collapsed to form a flat package, so that it can be placed conveniently in the vest pocket. The other cup referred to is adapted particularly for use at soda fountains and public dispensaries of beverages It is formed of a band of paraffine paper connected by an overlapped joint The bottom of the cup is made out of a star-shaped blank, the points of which are folded up on the sides of the cup, and serve not only to attach the bottom to the cup, but to reinforce it The cup is made of tapering form to permit of nesting

Mr Dexter M Rogers, of Boston, Mass, has dedicated to the public an insect-destroying bomb upon which he has just secured a patent. The bomb contains dry poisons in powdered form, and is arranged to be exploded when it reaches a certain height after being discharged from a gun The poisonous powder is thus distributed in the air, and gradually settles down on the leaves of the trees which are infected with the insects This method of treating the trees possesses the advantage that the powder will reach all parts of the foliage, and is applied with a great saving of time and labor

PATENTED ODDITIES.

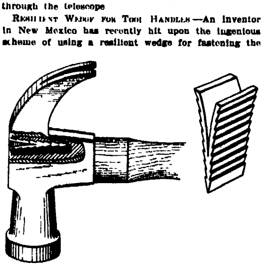
GUN BORE SIGHTING TELESCOPE.—A rather ingenious *method of testing* the sights of a gun has recently been patented by a German inventor It consists in placing the telescope in the bore of the gun, with its line of



TELESCOPE FOR TESTING GUN SIGHTS.

sight parallel to the axis of the bore The sighting device is then set to its zero position, and the gun is aimed at a distant object. The eye-piece of the telescope, which is shown in the enlarged sectional view, is fitted with a prism, so that the axis of sight intersects the line of aim at the eye In this way it is possible to make an observation by merely moving the eye to change the direction of vision, as indicated by the broken lines, whereas heretofore it has been necessary to move the head or even the entire body, in changing from an observation along the sights to one through the telescope

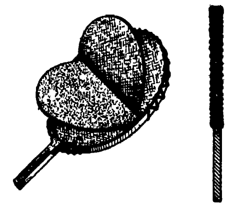
RESILIENT WEDGE FOR TOOL HANDLES.—An inventor in New Mexico has recently hit upon the ingenious scheme of using a resilient wedge for fastening the



RESILIENT WEDGE FOR FASTENING TOOL HEADS.

heads of tools upon the handles, the advantage of this being that when the wood is compressed through the use of the tool, the wedge will expand, and thus automatically tighten the handle The wedge as illustrated herewith is split, and is provided on opposite faces with ratchet teeth that serve to prevent its withdrawal from the wood. The tool head should also be formed with ratchet teeth inclined oppositely to those of the wedge, so as to prevent the handle from being withdrawn.

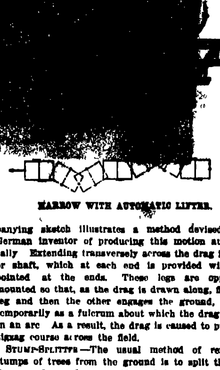
AIR-COOLING FAN.—It is well known that the circulation of air increases the rate of evaporation, and thus cools a moist body It is for this reason that we use a fan to produce an artificial draught of air over the



SELF-COOLING FAN.

face and absorb moisture from the skin An inventor has recently hit upon the idea of improving the efficiency of the fan by providing it with a moist pad, so that the evaporation will cool the fan The fan is made up of a rattan frame, as shown in the accompanying drawing, which is covered with two layers of cloth, between which is a layer of felt. The cloth layers may be removed to permit of taking out the felt layer to moisten it Undoubtedly, when the fan is operated it will grow colder, by reason of the evaporation of moisture from the felt. It is a question, however, whether the added moisture in the air absorbed [illegible] not to a certain extent de- [illegible] moisture from the [illegible]

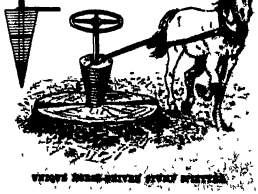
[illegible]—It is [illegible] and dur- [illegible] must fre- [illegible] produce [illegible] accom-



HARROW WITH AUTOMATIC LIFTER.

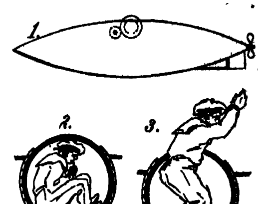
panying sketch illustrates a method devised by a German inventor of producing this motion automatically Extending transversely across the drag is a rod or shaft, which at each end is provided with legs pointed at the ends. These legs are oppositely mounted so that, as the drag is drawn along, first one leg and then the other engages the ground, serving temporarily as a fulcrum about which the drag swings in an arc As a result, the drag is caused to pursue a zigzag course across the field.

STUMP-SPLITTER.—The usual method of removing stumps of trees from the ground is to split them by the use of a wedge or a blast of dynamite The accompanying illustration shows a new method, [illegible] [illegible] a wedge into the [illegible] The wedge is in reality a large conical screw, provided at its lower end with a fine thread used for starting the cone into the wood. The shaft of the screw is provided with a hand wheel, by which it may be steadied and turned. Extending laterally from the shaft is a long arm, at the end of which a whiffletree is coupled. A horse may be hitched to the whiffletree, to turn the shaft and screw the cone into the stump When the stump is too large for the threaded cone on the shaft to split effectively, another cone-section may be added. After the stump has been split, by means of the cone, into a number of small parts, these parts can easily be excavated and removed



[illegible] HORSE-DRIVEN STUMP SPLITTER.

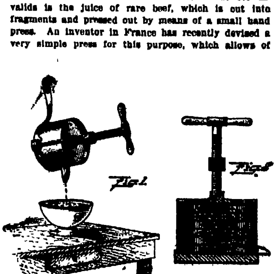
LIFE-SAVING HATCH FOR SUBMARINE BOATS.—When a submarine boat has been disabled and sunk, the occupants dare not attempt to escape, for if the hatch should be opened there would be an inrush of water,



LIFE-SAVING HATCH FOR SUBMARINE BOATS.

which would drown the crew before they could escape. An inventor has recently hit upon an idea, borrowed possibly from the revolving doors that are used in public buildings, whereby the crew can escape, one at a time, without admitting more than a measured quantity of water at each operation of the hatch. In this case a cylindrical hatch is used, provided with an opening at one side The hatch is mounted in water-tight bearings, and is connected by means of suitable gearing with a driving shaft, which will turn it on its axis, bringing the opening first into communication with the interior of the vessel, and then with the water outside To escape from the vessel, a man crawls into the hatch, as indicated in Fig 2, and then it is turned around to the position shown in Fig. 3, permitting him to dive upward through the water and escape

BEEF-JUICE PRESS.—One of the best foods for invalids is the juice of rare beef, which is cut into fragments and pressed out by means of a small hand press. An inventor in France has recently devised a very simple press for this purpose, which allows of



IMPROVED BEEF-JUICE PRESS.

expressing the juice of a large amount of beef at a time. The press is similar to the ordinary type, being formed of a suitable receptacle with a plunger, which is forced down by a hand screw. Instead of operating the plunger for each piece of beef, the device is arranged to take a number of layers of beef, which are separated by disks of corrugated and perforated metal, as shown in the cross sectional view, Fig. 2. The press is provided with a spout at one side, through which the juice is drained out into a cup or bowl. After the plunger has been forced down, the [illegible]

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

PNEUMATIC TIRE HEEL-CUSHIONS.—W. L. [illegible], [illegible], N. Y. This invention relates to pneumatic heel cushions which are adapted to be worn on the inside of the shoe at the heel for the purpose of providing a resilient cushion for the heel. The object is to provide a cushion with improved means for use in securing the cushion against moving forwardly on the shoe.

SAFETY-PIN.—W R DANCY and C. B WESTCOTT, Savannah, Ga An object of the invention is to provide a strong pin which can be released or opened by a simple manipulation which involves the use of one hand only; which is so constructed that it can be opened without grasping or handling the pin itself in any way, and which when closed is securely held against accidental opening. It is particularly useful in surgical work for pinning bandages.

Of Interest to Farmers.

CULTIVATOR PLOW.—G W PORANS, Geneseo, Ill. An object of the inventor is to provide a cultivator blade or shovel which will be more readily retained in ground that is rough, hard, or overgrown with weeds, than the ordinary blade. A further object is to provide a device in which the point of the blade is so constructed that it will readily enter the ground and does not have to be resharpened like the ordinary blade.

FIRELESS BROODER.—G H. LEE, Omaha, Neb. This invention has reference to fireless brooders such as are used by poultry brooders in raising chicks. The brooder is intended especially to be used without being heated by artificial means and the construction of the brooder is such as to retain the bodily heat which passes from the chicks.

PRESS FOR FRUIT.—T P MADDOX, Aztec New Mex This device maintains the covers of fruit crates in position to be secured to the body of the crate, and in securing the same The packing pressure for fruit may be applied while and in the act, of placing the cover in position The device holds the cover in position to be secured, which device carries in convenient position a receptacle for the fastening devices for securing the cover

Of General Interest.

CORD-RETAINER FOR PACKAGES.—M SCHMIDT, New York, N Y The aim here is to so construct the package that after the cord is once tied and its ends properly protected by a knot protector no one can open the package without either breaking the same, mutilating the cord-protector, or cutting the cord The device also serves to reinforce the package so that the cord may be drawn very taut without liability of crushing in the edge of the package or box.

GUN MUFFLER.—J H STIMSON, Cooke, Mont. In the present patent the invention is an improvement in gun mufflers or silencers and has in view means to arrest the forward movement of the escaping powder gases and give the same a backward curling motion at successive points, whereby they escape gradually and produce a but slightly audible sound.

METAL SEAL.—S. STROH, Audrey House, Ely Place, London, E. C., England. This invention relates to metal seals adapted to be closed on cords and the like used for fastening packages. The aim is to provide a seal which shall be cheap to manufacture which can be used without the necessity of threading the cords through holes therein and which, when secured in position, cannot be tampered with without detection.

BOOK HOLDER.—W C TRAHER, London, Ontario, Canada Mr Traher's invention relates to book holders, and particularly to book-holders for stenographic and other note books, a plate being provided which is pivoted to a cover of a note book, a bent wire with fingers being pivoted to the plate, and the fingers being adapted to engage and hold the covers of the book relatively to each other.

HARNESS BACK PAD AND COLLAR-PAD.—L P OVERHAUSER, San Diego, Cal. The pad is light yet duly flexible, and almost entirely relieves the friction between the portion resting in direct contact with the back of the animal and the portion to which the weight is applied by a strap or other means. The top plate is so arranged as to be limited in its endwise and lateral movement within certain limits. The weight is comparatively small.

COMPOUND FOR PRODUCING SILK-LIKE EFFECTS.—L. L. LILIENFELD, Zeltgasse 1, Vienna VIII, Austria. This invention relates to coloring matter for producing silk-like or pearl-luster effects, and such, for instance, as described in Letters Patent of the United States, formerly granted to Mr Lilienfeld. The aim is to provide a coloring matter for effects when applied to various articles made of wood, metal, paper, leather, textile fabrics, etc.

PHOTOGRAPHIC-PRINTING DEVICE.—T. [illegible] The aim here is to produce a device adapted to be [illegible] through the wall of a dark room, [illegible]

[illegible] being arranged to be opened when the paper is in place.

HANDLE.—G LEMIEUX, Washburn, Wis. This invention is an improvement in handles for trunks and the like, in which the handles proper are foldable, and when required for use are extended or drawn out. An angle-iron serves for the support and the reception of the handle, and strengthens and protects the angles of the same.

WATER-GUARD FOR CHIMNEYS.—W F GAMMILL, Atchison, Kan. In the erection of brick draft chimneys for houses, it is difficult to prevent rain water from passing down the walls of chimneys, and soiling the ceilings and side walls of rooms through which the chimneys pass. To overcome the defects, the inventor provides a peculiar construction of a water-guard in special combination with the walls of a chimney

COMBINED CARTRIDGE BANDOLEER, GUN REST, SHOULDER-STRAP, AND RECOIL-PAD.—R C WEST, Arbuckle, Cal In this equipment for soldiers and hunters, the bandoleer operates to retain the shoulder strap in place and the latter serves to carry the recoil pad and present it in proper position to receive the butt of the gun, the pad being preferably adapted to be detachably connected to either side of the strap in order that the appliance may be supported from either shoulder.

DEVICE FOR FASTENING BELTS.—G W SOUTHWICK, Noroton, Conn This improvement refers to belt joints of the hinge type, having wire eyes attached to the belt ends and a pintle engaging the eyes. For the purposes of the invention use is made of guiding means for guiding a piercing tool to provide the belt with apertures for the passage of the wire used for the hinge eye and looping means adjacent to the guiding means and around which the wire is passed to form the hinge eye.

Hardware and Tools.

HAME-TUG.—A L. SADDLEMIRE, Knox, N Y The intention here is to provide a hame-tug arranged to insure a straight pull on the hame sticks and without danger of cutting or otherwise injuring [illegible] this purpose a metallic clip [illegible] stick and is provided with [illegible] tending pivot on which is moun[illegible] metallic end piece of the [illegible]

CAN OPENER.—J McD [illegible] In this case the purpose [illegible] to provide a can opener of [illegible] struction, wherein the blade [illegible] near the handle but is ad[illegible] away therefrom to permit [illegible] the blade to be sharpened [illegible] require.

Heating and [illegible]

PORTABLE HEATER [illegible] Youngstown Ohio. The [illegible] tion is to provide a device [illegible] ufacture, which is of co[illegible] carried in the pocket of [illegible] is provided with two [illegible] bination with the body [illegible] which an object to be h[illegible] tioned The device is adap[illegible] liquid fuel, such as alcohol

GAS-MAIN STOPPER.—P GOODMAN, New York, N Y This invention provides a projection in connection with the ring or eye carried by one of the handle bars, arranged to engage the inner wall of the main at the opening and prevent the bar from pulling out of the main under the action of the locking means, the projection and eye being adjustable along the length of the handle-bar to accommodate the stopper to the point at which it is placed in the main, the eye being arranged close to the outer wall of the main when the projection is engaged.

Machines and Mechanical Devices.

PRESS-COPYING DEVICE.—H A BENNER, Washington, D C By this device clear and perfect copies may be made from type-writing made with ordinary copying ribbons and from writing made with ordinary copying inks, indelible pencils, etc., no special, heavily inked or quick-copying ribbons or inks being necessary, as in the ordinary copying devices of this type, thus obviating the smearing and blurring of letters before copying, and during the process of copying, as where quick-copying ribbons or inks are used.

BUSH PULLER.—J G O'DONNELL, Washington, D. C. The present invention is an improvement in the class of machines or implements adapted for grubbing or pulling bushes. The improvement is embodied in the roller and spring attachment and in draft devices applied to the lever The bush or sapling puller is distinguished by simplicity, lightness, ease in manipulation and effectiveness in operation.

GILL-BOX DRAWING-HEAD.—H. L. OTTENMANN, 21 Bismarckstrasse, Leipsig, Germany In the drawing process of this invention an auxiliary hammer or cam is employed, by means of which the fallers are pressed down up to their intermediate position in such manner as to allow the withdrawal of the front row of pins from the sliver. In the construction [illegible] of which the hammer has to work on the fallers, both are subject to much wear, so that the lowering of the fallers is uncertain, and as the hammer forms one piece with the gill screw, it has been necessary to replace it by a new screw This disadvantage the inventor overcomes.

FIRE-ESCAPE.—J W THOMPSON, Hinchcliff, Miss. The object here is to provide a fire escape with a drum, a worm wheel secured to a shaft journaled in the frame, a second shaft being provided for a gear wheel a worm the worm engaging the worm wheel, and the gear wheel on a third shaft, which has also a bevel gear which meshes with the bevel gear on a hand wheel, by which the mechanism is operated

VAULT-CLOSURE.—F UNCKRICH, Galion, Ohio. The invention refers to a closure intended for locking and hermetically sealing grave vaults and the like and consists of a door which can be locked in position at a door frame so that it cannot be opened from the outside without destroying the frame or door and which further can be so adjusted that if desired it can be opened from the outside without injury thereto, after it has been locked in position.

SANCTUARY-LAMP.—L M WILDE, North Walpole, N H In the present patent the invention is an improvement in sanctuary lamps and it has in view a motor-driven mechanism, to trim the carbon from the lamp wick during the burning of the lamp the said mechanism being inaudible in action and assembled compactly with the lamp proper

TRIGGER MECHANISM.—R. R WILLIAMS St Joseph, Mo This invention refers to trigger mechanism such as shown and described in Letters Patent of the U S., formerly granted to Mr Williams. The aim of the present invention is to provide certain new and useful improvements in trigger mechanisms, whereby an auxiliary can be readily set for action whenever it is desired to provide a sensitive action of the trigger mechanism

FLUID-OPERATED CONTROLLING MECHANISM.—J W ANDERSON, Sisson Cal. An important feature of the present invention involves the forming of the valve by relatively movable parts of the supply and exhaust conduits, and another important feature involves [illegible] piston, so [illegible] rod [illegible] a [illegible] device [illegible] plate [illegible] to be [illegible] the [illegible] and [illegible] the edge [illegible] is [illegible] this [illegible] Halifax, [illegible] to [illegible] under- [illegible] A further object is to provide means for adjusting the device so as to make recesses of various sizes and shapes.

PROCESS FOR MAKING SHOES.—A H PANNELL, Halifax Pa In the present patent the invention has reference to improvements in shoes and is more particularly applicable to those shoes designed for the use of children in which a wedge is inserted under the heel seat to raise the heel while at the same time preserving the continuity of the bottom from the front to the extreme rear

FLEXIBLE CONNECTION.—F W RAADEN Newark N J This invention pertains to certain improvements in flexible connection especially designed for use in connecting rotating members. The improved connection in itself constitutes a universal joint and may be used in any form of apparatus or machinery in which universal joints are desired It is particularly desirable for use in small flexible shafts.

TRANSMISSION-GEARING.—J K KOONS, Montgomery, Pa On the transmission shaft a plurality of gears is loosely mounted and means is provided for keying the gears to the shaft in succession or for freeing all the gears, a driven shaft has a single loose gear with shiftable keying and means, a keying means in one direction secures the gear on the driver shaft while a movement in the opposite direction directly connects the transmission shaft to the driven shaft. An examination of the patent is necessary for a full appreciation of the mechanism.

Prime Movers and Their Accessories.

CARBURETER.—T J FAY, New York, N. Y., and J M ELLSWORTH, Bernardsville, N J One of the objects of this improvement is to provide a device adapted to automatically control the supply of charge to the engine until said engine acquires a definite predetermined speed, at which time the device automatically admits additional air and automatically increases the quantity of said air as the speed of the engine increases above the predetermined limit.

GAS-ENGINE.—C BRINKMANN, New York, N Y. The invention comprises a compact arrangement of cylinders about a central shaft, having inclined or skew wrist pins or cranks, and by means of the cranks the reciprocating movement of the pistons is transformed into a rotary movement at the shaft The wheel is so constructed that it operates as a valve controlling the admission and exhaust of the cylinders.

Railways and Their Accessories.

EXTENSIBLE CONNECTION.—M I WELLS, Massillon Ohio This improvement has reference to extensible connections, and admits of general use the inventor's more particular intention being to provide a member built up of rods movable relatively to each other and provided with means for shifting the rods in order to vary their aggregate length

MINING CAR.—J BLAIR, St Benedict Pa The object here is to provide a car arranged to readily withstand the rough usage and jolting of the car when in use to maintain the axles in a right angled position relative to the longitudinal center line of the car with a view to insure proper running and to prevent the car being twisted out of shape when in use.

RAIL-JOINT.—W BARNETT, Hackettstown, N J The object of the present invention is to so construct the bearings of the cams on the bottom flanges of the fish plates that a downward pressure on either the cam or the nut will not tend to slide the cam outwardly, but the said flange will operate to support the cam in operative position

Pertaining to Recreation.

PUZZLE.—C BRUDERLEIN New York N Y This device comprises an elongated box having an elevated runway along which small balls or shot may be guided from one end to the other At one end a plurality of pockets are provided which may receive the balls and in addition special means provide for returning the balls to the end remote from the pockets, and for bringing them into position for advancing them into the pockets.

GAME.—J R NIXON New Orleans, La The purpose of Mr Nixon's invention is to provide an amusing and instructive game wherein a field having hazards is provided and a balanced lever to one end of which is connected figures adapted to be moved into view when the lever is rocked by the weight of other figures movable over the field.

Pertaining to Vehicles.

ADJUSTABLE PATTERN FOR TONGUE HOUNDS.—N J SMITH, Halstead, Kan In this instance the invention relates to certain improvements in patterns for use in the manufacture of tongue hounds for wagons and the aim is to provide a pattern so constructed as to permit of its use in marking out hounds of various different shapes and forms.

WIND-SHIELD.—E J MONTIGNY New York, N Y This improvement relates to wind shields for use in connection with automobiles and other rapidly moving vehicles the more particular purpose being to provide a wind shield comprising a two part sash adapted to fold neatly into the dash board which is of special structure in order to receive the shield

WAGON SEAT FASTENER.—L M LATTIMOUR Shubert Neb This invention is embodied in devices adapted to support and clamp a seat detachably upon the sides of a wagon body In order to detach the seat from or adjust it on, the body it is necessary to first turn the roller to bring its cam out of contact with, or away from the wagon side In order to adapt the roller to a firm hold on the wagon side, the cam or eccentric portion thereof is provided with obtuse angled grooves.

BUGGY SHAFT TUG.—W G PETERS Danbury, N C The improvement is in buggy shaft tugs and the purpose of the inventor is to provide a device of this character which will obviate the necessity of slipping the tug over the end of the shaft and wherein the shaft will automatically enter and lock the tug when it is lowered into place

VEHICLE TRACTION MECHANISM.—J L WILLIAMS, Ellsey Fla The principal objects which the present invention has in view are to provide a mechanism wherein the traction is obtained through members which are positive in their engagement with the ground, to provide a mechanism adapted to operate in broken and unequal ground and to provide a driving mechanism simple, elastic and durable

VEHICLE-WHEEL.—J W CARHART, Austin, Texas. In this patent the tire comprises a series of laminæ arranged side by side and provided with openings for dowel pins passing through the openings A ring plate is arranged on each side of the tire and against its inward face the adjacent ends of the pins abut bolts traversing the plates for securing them in place, and an elastic envelope on the outer face of the tire and lapped on the sides thereof, the edges of the envelope abutting the edges of the plates, and nails driven through the envelop into the laminated body of the tire.

NOTE.—Copies of any of these patents will be furnished by Munn & Co for ten cents each. Please state the name of the patentee title of the invention, and date of this paper

Notes and Queries.

HINTS TO CORRESPONDENTS.

The full name and address must accompany all letters, or no attention will be paid thereto. This is solely for our information. *All* queries are answered by mail, and a *few* of the selected answers are afterward published in the paper. We cannot undertake to furnish information on matters of personal interest, without reasonable compensation. To answer questions which are not of general interest usually costs us from \$2.00 to \$3.00 each upward, and this sum should invariably be remitted in such cases. When there are questions involving building or other construction, or when calculations must be made, an estimate of the cost will be furnished upon request. We cannot give answers to examination papers, or decide wagers, nor can we undertake to solve mathematical problems of any description whatsoever. Do not use postal cards. Do not telephone inquiries, we cannot do justice to them.

Queries from this vicinity not answered within fourteen days should be repeated in full. Queries from points more remote will require a longer time.

We do not make chemical analyses, but we are always pleased to give the names of minerals which are submitted to us, when it is possible for us to do so. The minerals should be sent marked distinctly with the name of the sender, and should be sent fully prepaid.

Buyers wishing to purchase any article not advertised in our columns will be supplied with the addresses of the houses manufacturing or carrying the same, as soon as possible, or if we are unable to do so, their queries can be advertised in our special classified column.

Any books on any scientific or technical subject can be furnished. We solicit requests for quotations. The SCIENTIFIC AMERICAN SUPPLEMENTS referred to are mailed for ten cents each. Book and SUPPLEMENT catalogues will be sent free on request. A careful reading of these "Hints to Correspondents" will prevent any misconception as to the uses and will prevent abuses of this column.

(12242) J C G says: If the world was perfectly round and smooth and a belt was fitted around the center, perfectly tight, without a fraction of slack, and the belt when thus fitted was exactly 25,000 miles long, and this same belt was lengthened 18 feet, how much would this belt, after being thus lengthened, stand out from the earth's surface, supposing that the earth was exactly in the center of the belt? I have a bet with some men that the belt will not stand out from the surface 2 96/100 feet at all places, and to convince them I am right, I have been referred to you as authority. They argue that the diameter of the belt after being lengthened will be six feet more than when measuring 25,000 miles. It is absurd I think, but at the same time I would be glad to know the fraction it would be supposed to leave the surface. A. We make it a rule not to settle bets, but as this is a simple statement of fact, and the result of the bet depends not at all upon our judgment, which can be proved to you by anyone with a sufficient knowledge of simple arithmetic and the value of π (the relation between the diameter of a circle and its circumference) and as you would doubtless obtain a decision elsewhere, we do not like to seem discourteous by refusing to answer your question. The only consolation we can give you is that it was not a fair bet, as your opponents were betting on a certainty. Incredible as it may seem that the addition of so trifling an amount as 18 feet to a belt 25,000 miles long should increase its diameter nearly three feet, such is undoubtedly the case. It is figured as follows, and there is no way of figuring it otherwise. A more accurate value of π, say to ten instead of five places of decimals, would reduce the amount by an insignificant trifle. The difference of 0.14 between our result and that of your opponents is easily explained by their having used a different approximation of the value of π. The circumference 25,000 miles of the belt you suppose $\pi \times d = 3.14159\, d$; therefore the assumed diameter of the globe would be

$$\frac{25\,000}{3.14159}\text{ miles} = \frac{132{,}000\,000}{3.14159}$$

feet $= 41\,422\,920$ feet. The diameter of the belt when its circumference is lengthened by 18 feet is

$$\frac{132\,000\,018}{3.14159}\text{ feet} = 41{,}422\,925.64{,}858$$

feet. The diameter is therefore increased in length by the difference $= 5.64\,858$ feet and the lengthened belt will stand off from the globe by half that amount or 2.82,429 etc., feet.

(12243) K A R asks: Will you explain through the columns of your paper the following? A person said to me that the earth makes a complete 'wobble' once every 25,800 years, i. e., the North Pole changes its position in relation with the stars and consequently another star is designated the North Star. When asked what caused this wobble, he replied that it was similar to the wobbling of a top whose energy is nearly spent. The point that I do not understand is this. In the case of the top, after its rotation has decreased to a certain extent, the attraction of gravity overcomes the gyroscopic force and therefore causes the top to wobble, but in the case of the earth, there is no attraction other than that of the other heavenly bodies which is practically equal in all directions. Therefore why should the earth wobble? and is the rapidity of the rotation of the earth decreasing? A. The subject about which you inquire is called in the astronomies "the precession of the equinoxes." Any astronomy which may be in the library of your city will give you all the information you require on this matter. The poles of the heavens move, not visible, around the poles of the ecliptic in a vast period of 25,000 years. This causes the North Pole to move away from the Pole Star of our times, till in 12,500 years it will be 47 degrees away from it. Alpha Lyrae will then be the Pole Star. Precession is due to the attraction of the sun and the moon upon the ring of earth around the equator, as they are alternately on one side and on the other side of the ring. The attractive force of the sun and moon is combined with the centrifugal force of rotation of the earth to produce this extremely long period of precession. If you are not able to find any satisfactory work in your public library we can send you Todd's "New Astronomy" for \$1.50. The motion of precession is very like that of the spinning top when its axis is slightly out of plumb.

NEW BOOKS, ETC.

MODERN COKING PRACTICE. By T H Byrom and J E. Christopher. London. Crosby Lockwood & Son. New York: The Norman W. Henley Publishing Company, 1910. 8vo.; 168 pp. Price, \$2.50 net.

The subject of coke manufacture is of rapidly increasing interest and significance, embracing as it does the recovery of valuable by-products in which scientific control is of the first importance. It has been the aim of the authors, in compiling this book, to produce one which shall be of use and benefit to those who are associated with, or interested in, the modern developments of the industry. While the book embodies, with some amplifications, a series of lectures delivered by J E. Christopher, at the Wigan Technical College, to a class of men engaged on coke ovens, the authors entertain the hope that the work will be appreciated by students generally, and by many who are engaged in coke manufacture, or who contemplate the laying down of a by-product plant. Every endeavor has been made to present the facts as completely up to date as possible, and if [illegible]

[illegible] terially from [illegible] formula on which the method is based. A method to be universally acceptable must be based on theoretical formulæ and embody all of the requirements that occur in the building ordinances that govern construction in the various localities. It must be rapid and accurate in its applications, and if possible give at a glance the final result of changing any one or more of the assumed variables of design.

ATKINSON'S SIGN PAINTING UP TO NOW. By Frank H Atkinson. Chicago: Frederick J Drake & Co, 1910. Oblong 4to., 378 pp. Price, \$3.

This is a very handsome book on sign painting and the design of show cards with valuable alphabets, which contains 96 designs of lay-outs and accompanying color notes. There are 75 alphabets embracing all standard styles, their modifications and alterations, together with comprehensive text covering all practical phases of the art. There are a number of illustrations in the first part of the book showing how the work is actually done. These are specially valuable and we have not the same in any other book. The work seems to be eminently practical and the technical matter reflects the best usage in vogue at the present day.

THE LIFE OF WILLIAM THOMSON, BARON KELVIN OF LARGS. By Silvanus P. Thompson. Two volumes. New York and London: The Macmillan Company, 1910. 8vo.; 1,297 pp. Price, \$7.50 net.

One would naturally expect that a biography of Lord Kelvin, written by a prominent physicist, such as Silvanus P Thompson, would deal largely with the scientific accomplishments rather than the personal life of the subject, and this is, in a measure, true. A picture of Lord Kelvin's life and home relations has already been written, by his own sister. The present volumes, however, take up the life of this great man from a different viewpoint, that is, in relation to his special work in the realms of science. The present biography was begun nearly two years before the death of Lord Kelvin. Hence it was possible to obtain much valuable information and many personal reminiscences, which give the volumes [illegible] the importance of an autobiography, while at the same time due prominence is given to certain matters which might have been modestly passed over had Lord Kelvin been writing his own life story. The biography is made up to a large extent of manuscripts and scientific correspondence, and the author has wisely avoided placing his own interpretation upon them, preferring to let them speak for themselves. The work is intensely interesting from cover to cover, despite the fact that the work of Lord Kelvin was far in advance of the majority of his fellow men. The reader is brought into intimate association with the young man who struggled to the foreground in his college days, who in his very earliest days as a scientist did much to bring the theories of Joule into prominence, who as the foremost electrician in his time was the master mind in the problem of bridging the Atlantic Ocean by cable, and whose later work in the study of tides, mathematical astronomy, physics and electricity carried him far above any other man of his times. The two volumes are handsomely bound, and should make a most important and attractive addition to the library of the layman as well as the technical man.

MODERN ASSAYING. By J Reginald Smith. Edited by F W Braun. Philadelphia, 1910. 16mo.; 145 pp. Price, \$1.50.

The present book is not intended to be an exhaustive exposition of the subject, nor to take the place of the many excellent works on assaying, but rather to present in a concise, intelligible, untechnical way the science and methods for the assay of precious metals so that the reader may in the shortest possible time acquire the necessary knowledge to enable him to follow out practical work. They who have mastered the first ground work will soon gain all the rudiments of the science and use of the apparatus. The Editor has the advantage of being in the business of supplying assay and chemical laboratories. There are too many books on chemistry and assaying which are written by theorists. The book is admirably illustrated and may be considered [illegible] contribution to the subject.

[illegible]

[illegible] postage 50 cents.

[illegible] an account of the theory and practice in the production of all kinds of cabinet work and furniture, with chapters on the growth and progress of design and construction. It is illustrated by over 1,000 practical workshop drawings, photographs, and original designs. The book is particularly well made and the illustrations are of satisfactory size. There are many half-tones included in the text, showing exactly how the work is done. We have often wondered why it was that no one had gotten up a book showing how to use the hands in cabinet making, which is a most interesting trade or amusement, depending on whether the person is a professional cabinet maker or an amateur. Wood working in England has a vogue among amateurs which is entirely wanting in this country. This is probably owing to the fact that they lack proper instruction. This book will give them exactly the information which they are seeking. Among its many good points is a chronological chart giving names, periods, dates, general characteristics and proportions of chairs and seats in various styles. The whole book bears the impress of careful work, and there is little question but that it will have a considerable sale in this country among amateurs. There is also an excellent glossary.

"FLIGHT" MANUAL. A REFERENCE BOOK OF NOTES, FORMULAE, AND TABLES. By Algernon E. Berriman. London: Published by "Flight," 1910. 16mo.; pocketbook size. Price, \$4.20.

Two main objects associate with this book; one is to form a [illegible] of what is hoped will become the standard work of reference on flight and aeronautics; the other is to provide a key to the articles appearing in the weekly periodical "Flight," whereby new readers may be enabled to pick up the subject with facility. [illegible]

[illegible]

GLIMPSES AROUND THE WORLD THROUGH THE EYES OF A YOUNG AMERICAN. By Grace Marine Stein. Philadelphia: The John C. Winston Company, 1910. Illustrated. 8vo.; 461 pp. Price, \$2.

Of books of travel there seems to be no end, and every book seems to have much of value in a field of its own. The volume before us is very readable and profusely illustrated with engravings, the originals of which [illegible] have been selected with [illegible] usual care. The book is printed in large type on good paper and is worthy of an extended sale.

APPLIED MECHANICS. By David Allan Low, Whitworth Scholar, M.I. Mech. E., Professor of Engineering, East London College, University of London. London, New York, Bombay, and Calcutta: Longmans, Green & Co., 1909. 551 pp., 359 illustrations. Price, \$2.75 net.

Mr. Low has succeeded in crowding a great deal of matter between the covers of this text book for engineering students. It embraces strength and elasticity of materials, the theory and design of structures, the theory of mechanics, and hydraulics. The matter is presented in a very clear and concise manner. The author believes thoroughly in the importance of exercises to fix a subject upon the student's mind. Accordingly a large part of the book is devoted to various exercises, there being 780 in all, 600 of which are original. The remainder have been selected from various examination papers. The book should occupy an important place in the student's library.

DESCRIPTIVE METEOROLOGY. By Willis L. Moore, LL.D., Sc.D. New York and London: D. Appleton & Co., 1910. 8vo.; 344 pp.; 45 charts and 31 illustrations. Price, \$3 net.

The author's present office as chief of the United States Weather Bureau, as well as his thirty odd years of experience in this connection, give the present work the stamp of authority. The purpose of the book is to instruct young men entering the service of the United States Weather Bureau, who have been hampered in the past by not having up-to-date text books on the rapidly progressing science of meteorology. However, the book has been written in such style as to appeal to the layman as well as the student. Technical terms have been carefully explained, for it is assumed that the reader knows little or nothing about the subject. Certainly every one is interested in the weather, and should welcome an opportunity such as this of making himself acquainted with the laws which govern the movements of storms. A chapter has been devoted to weather changes, which should enable the layman to make a good forecast with the aid of the daily official weather map. The study of meteorology is taken up in its broadest sense, with reference not only to the lowermost strata which directly concerns us, but to the entire depth of the earth's atmosphere, the latest study of the upper layers by means of sounding balloons and the part that is played by the sun and the motion of this planet about it.

THE STUDENT'S MATRICULATION GEOMETRY. Books 1-4. By Saradakanta Ganguly, M.A. Calcutta: The Students' Library. 12mo.; 248 pp.

This book has been written in strict conformity with the syllabus prescribed by the Calcutta University for the matriculation examination. A second edition of this book has just been issued, the first having been very well received by the teaching public.

CONIC SECTIONS MADE EASY. By Saradakanta Ganguly. Calcutta: Students' Library, 1909. 97 pp.

[illegible]

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending June 7, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Valve, [illegible], B. [illegible]	960,[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Well drilling machine, U. H. Waterman	960,[illegible]
Wheels, separable rim for vehicle, T. J. Moll	960,[illegible]
Wind motor, A. V. [illegible]	[illegible]
Window [illegible], J. T. [illegible]	[illegible]
Window [illegible] device, [illegible] lock, [illegible] [illegible], H. G. Voight	960,[illegible]
Window cleaning utensil, C. W. Coover	960,[illegible]
Window screen, A. E. Paddison	960,[illegible]
Wire stretcher, L. H. Cooper	960,512
Wire winding machines, notching attachment for, G. W. Stancliff	961,089
Wood bending machine, C. W. Elliott	960,025
Wool washing machine and the like, F. G. Sargent	961,038
Wrapper, J. Greenberg	960,551
Wrench. See Pipe wrench.	
Wrench, L. Pausaw	960,691
Yarn waxing device, N. B. Kahn	960,335

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

A TELEPHONIC STETHOSCOPE.

(Concluded from page 496.)

two diaphragms A and D In this manner all sound except that particularly desired is eliminated. Thus it is possible to hear only heart beats, or the distinctive sound characteristic of any other organ to the exclusion of all outside noises so that attention can be concentrated upon that essentially desired When the instrument is tuned to diagnose the respiratory organs the passage of the air through the lungs is heard in the telephone as a rushing roar of wind

With this instrument it is quite feasible for a physician to examine a patient stethoscopically from a distance over the ordinary telephone. [illegible] that is necessary is to conne[illegible] ratus with the telephone servi[illegible] manner it has been possible [illegible] the sound of heart beats o[illegible] distances, and the supreme [illegible] direction was when the [illegible] placed on the heart of a [illegible] don, and the beats were [illegible] by physicians in the Isl[illegible] matter of 100 miles or s[illegible] instrument is far more sens[illegible] than the stethoscope ordi[illegible] if any noise is created in t[illegible] which the examination is b[illegible] out, it is very distinctly and [illegible] ably heard at the receiving e[illegible] viate the discomforts of this [illegible] possible, the instrument is w[illegible] and should be used in a quiet r[illegible] the tube B and the diaphragm A [illegible] moved and a funnel substituted, [illegible] strument will collect and intensify to an extreme degree the slightest sound, an ordinary conversation being converted into a deafening shout at the receiving station

The instrument has also been adapted to other phases of work such as the electrophone and wireless telegraphy with similar success. In the former case when the receiver is connected to a trumpet the sounds are distributed throughout the room, while in connection with etheric telegraphy it has enabled impulses, which were so feeble as to be undetected, to be picked up, and distinctly read by the operator at some distance from his instrument.

THE FLIGHTS OF ROLLS, DE LESSEPS AND CURTISS COMPARED.

(Continued from page 502.)

seat of one of these machines under any conditions.

De Lesseps used a 1910 Blériot for his channel flight. This model is not greatly changed from the machine that carried Blériot across to England It is somewhat stronger in the framing and the power of the tail has been increased by enlarging both the stabilizing and the rudder surface, and by placing the stabilizer at the same level with the rudder. Even the vertical rudder is slightly larger.

Rolls is said to have flown in a French-built Wright machine. As he used a Short-

(Continued on page 510.)

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY - You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. In every case it is necessary to give the number of the inquiry. Where manufacturers do not respond promptly the inquiry may be repeated.

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BUSINESS OPPORTUNITIES.

100 PER CENT profit selling the Lindsay soft inverted mantles; fit any inverted gasoline light. Steady customers in every town. Fine side line for salesmen. Vest pocket samples and prices on request. Lindsay Light Co. Dept. 8, Chicago.

Inquiry No. 8918.—For manufacturers of "Wydt's Electro-Catalytic Sparking Plug."

PATENTS FOR SALE

PATENT No. [illegible].—For sale or royalty. A hook and eye. No hump, the eye does it, and does it better. For further particulars address M. M. Cowles, Hartford Avenue, Milwaukee, Wis.

Inquiry No. [illegible].—Wanted the manufacturers of the Van Winkle Woods & Sons, and the Weber power motors.

PATENT No. [illegible].—Breech mechanism. Much stronger than any other, for sale with inventions for increasing the rapidity of fire and accuracy of heavy ordnance. E. A. S. Hammar, [illegible] N. North St., Butler, Pa.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc. to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

WANTED

PRACTICING ATTORNEY of ten years' experience, would like to join forces with large manufacturing or contracting firm. Best of References. Address Lock Box 381 Syracuse, N. Y.

Inquiry No. 9016. Wanted, machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

LISTS OF MANUFACTURERS

[illegible]

SALE AND EXCHANGE.

[illegible]

MISCELLANEOUS.

[illegible]

Inquiry No. 9166.—Wanted, the address of O. Schurmann Street Sweeper and O. H. Butler Contracting Co.

Inquiry No. 9167.—Wanted, the address of the German Quartz Co.

Inquiry No. 9168.—Wanted, the name of manufacturer making the [illegible] Spring Terminal, sometimes called spring clip.

(Continued from page 500.)

Wright biplane before, it is safe to surmise that his cross-channel flyer was one of the new, powerful French Wrights, with a double horizontal rudder (a surface in the rear added, which as in the Farman machines, acts in unison with the front rudder). This is in accord with the Wrights' tendency to increase the power of the controls to the highest possible pitch, and at the same time it acts somewhat like an automatic steadying device. Any surface in the rear tends to steady.

In practical results Curtiss's flight may be said to have been the most fruitful of the three. This is due to its entirely unprecedented sustained speed over [illegible] long dist[illegible] ture that [illegible] Curtiss [illegible] In do[illegible] before [illegible] he de[illegible] A [illegible] suffic[illegible] with [illegible] supr[illegible] for in[illegible] chine [illegible] tor w[illegible] he had [illegible] so ha[illegible] cycle [illegible]

Wha[illegible] simply [illegible] plane [illegible] it is an [illegible] ful traf[illegible] of war, [illegible] th[illegible] short period of calm is rarely difficult to find, but that during such a period a Curtiss machine with its capacity for very high, sustained speed, may render services of the greatest practical usefulness. To many a business man it might be highly desirable if he could cover a distance like that from New York to Albany, between places where there is no direct railroad connection, with a speed exceeding that of the fastest express train, with comparatively slight expense and whenever half a day's calm weather can be counted upon. In war, the Curtiss type of machine may become a decisive factor in spite of its comparatively small carrying capacity.

Calm weather may be dreaded like the plague by the commanders-in-chief of future campaigns. The small, speedy Curtiss machines may be as immune from attacks from the ground as mosquitoes in the air. They may not only scent but also paralyze operations, not by throwing dynamite (their small supply would be exhausted before any great damage was done), but by setting things afire with the smallest quantities of burning chemicals—a modern revival of the Greek fire. These machines cannot be kept out of any part of the country they may choose to lay waste to. All this emphasizes how each step ahead in the conquest of the air demonstrates all the more clearly the dependence of the air pilot on the highest development of meteorological science.

THE TEMPERATURE OF THE STARS.

(Continued from page 501.)

much higher than the temperature of the electric arc (3600 deg. C., or 6512 deg. F.) agrees very well with the values obtained for the temperature of the sun, by actinometric or pyrheliometric methods, by Wilson (5773 deg. C., or 10.403 deg. F.) Scheiner (6200 deg C., or 11,192 deg F.), and Féry and Millochau (5360 deg. C. or 9680 deg. F.)

The following table contains some of Nordmann's determinations of the temperatures of stars.

NAME OF STAR.	TEMPERATURE. DEG C.	DEG F
Rho Persei	2870	5200
Beta Cephei	4260	7700
Gamma Cygni	5620	10150
Chi Herculis	7350	13250
Polaris	8200	14800
Alpha Lyrae	12200	22000
Alpha Persei	13300	24000
Gamma Lyrae	14500	26100
Epsilon Persei	15200	27400
Delta Persei	18500	33300
Lambda Tauri	40000	72000

Independently of these thermal measurements, Nordmann's method, in connection with the spectral analysis of stars, gives information concerning their comparative stages of development. These very high temperatures explain the fact that in some of the stars the spectroscope reveals the existence only of elements like hydrogen, nitrogen and carbon, and the compound of carbon and nitrogen called cyanogen, which is indissociable by heat.

Nordmann's apparatus also opens many new prospects in photometry, a science which is still in its infancy, except as regards the sun, although the exact measurement of stellar radiations, like that of stellar positions, is an indispensable prerequisite to the knowledge of the constitution of the stellar universe.

The observations made at Harvard University and at Potsdam, Germany, in connection with the publication of the great photometric star catalogues, have begun to blaze the path, which astronomers have thought less difficult to follow than it really is. In determining stellar magnitudes, the American and German observers merely measured with the photometer the total luminosity of each star, but, as the stars are of different colors, the values thus obtained are affected by errors of physiological origin. Furthermore, it has long been known that estimations of the brightness of variable stars, especially red stars, exhibit great individual differences. A comparison of the catalogues of Harvard and Potsdam shows differences in the recorded brightness of red stars. If in one catalogue the ratio of the brightness of a red star to that of a white star is represented by E, it will be represented in the other catalogue by 3/2E. These systematic differences appear to be due to two distinct causes. The first source of error is purely physiological and consists in the fact that sensations of color are produced by the excitation of the terminal filaments of the optic nerve, which line the retina, and which are of three different sorts, sensitive respectively, and almost exclusively, to rays of the red, the green, and the blue and violet portions of the spectrum. Now this relative sensitiveness varies greatly in different individuals, as is strikingly illustrated by the extreme and pathological case of Daltonism, or color blindness. The luminous sensation produced by a given star, that is to say, the aggregate effect, impressed upon the filaments of the three different kinds, differs in different individuals. The second cause of error is found, apparently, in the phenomenon discovered by Purkinje, which may be expressed as follows: If two sources of light, one blue and the other red, appear equally bright to the eye, and if the brightness of each source is then diminished in the same proportion, the red light will appear less bright than the blue. The result is that, for the same observer, the estimation of the color of a star depends, other things being equal, upon the magnitude of the star and the aperture of the telescope. Additional complications are introduced by the age of the astronomer, the position of his eye in respect to the eye piece, the degree of ocular fatigue, etc. Fortunately, Nordmann's photometric method eliminates these errors in the determination of the total luminosity of stars. It makes possible an exact study of the colors of stars and of the dispersion of light in interstellar space. Finally, it will undoubtedly give information concerning the intrinsic mechanism of the strange and mysterious transformations of variable stars of all classes.

A Storm-Warning Service for Aeronauts.

Dr Franz Linke director of the Meteorological Institute of the Physikalischer Verein at Frankfort-on the Main, has published a report on the special storm-warning service that he organized last summer in connection with the International Aeronautical Exposition. This service, being the first of its kind, was experimental, but proved so successful that a similar undertaking is likely to be a feature of all future aeronautical competitions on a large scale, especially if held in a region of frequent thunderstorms

The prediction of large general storms can be safely left to the national weather services that now exist in all civilized countries Local storms, however, and especially thunderstorms, are notoriously difficult to forecast on the basis of the widely scattered reports that make up the ordinary weather map and that are all that the forecaster ordinarily has at his command The attention of the Frankfort service was directed especially to the prediction of thunderstorms The life history of these storms is now well understood thanks to the brilliant investigations of a small group of meteorologists of whom M Durand-Gréville is the most conspicuous In the great majority of cases they sweep across the country in a long line that may be compared to the front of an advancing army —the "thunderstorm front"—at a speed averaging, in Europe, about 40 kilometers an hour The line of advance keeps a position more or less parallel to itself, and its progress is not difficult to predict, if its existence and position are known at any given time The prerequisites of successful thunderstorm prediction are a dense network of reporting stations and a system of adequate telegraphic communication with the central station

Dr Linke engaged the services of fifty five observers constituting a picket line of 150 kilometers radius around the city of Frankfort These were mainly recruited from among the volunteer observers already reporting, but not by telegraph, to the existing meteorological institutes of Southern Germany These persons were requested to send an 'urgent' telegram to Frankfort whenever a thunderstorm or a wind-squall (which is first-cousin to the thunderstorm) appeared in their vicinity between the hours of 7 A M and 7 P M The compensation offered was a free entrance ticket to the exposition and a copy of the published results of the experiment

The result of these arrangements was most gratifying, as, with one or two exceptions, all the thirty-seven thunderstorms that reached Frankfort during the three months of the exposition were duly heralded an hour or more before their arrival

It is noted that no aircraft attempted to fly in the face of providence—and the weather forecaster—except the big Zeppelin," which began its famous voyage to Cologne against the advice of the forecaster and promptly ran into a heavy thunderstorm.

The entire cost of the service was only 600 marks ($150), an insignificant amount compared to the value of a single large airship, to which, as well as to the lives of aeronauts, an effective storm-warning service accordingly offers a cheap form of insurance

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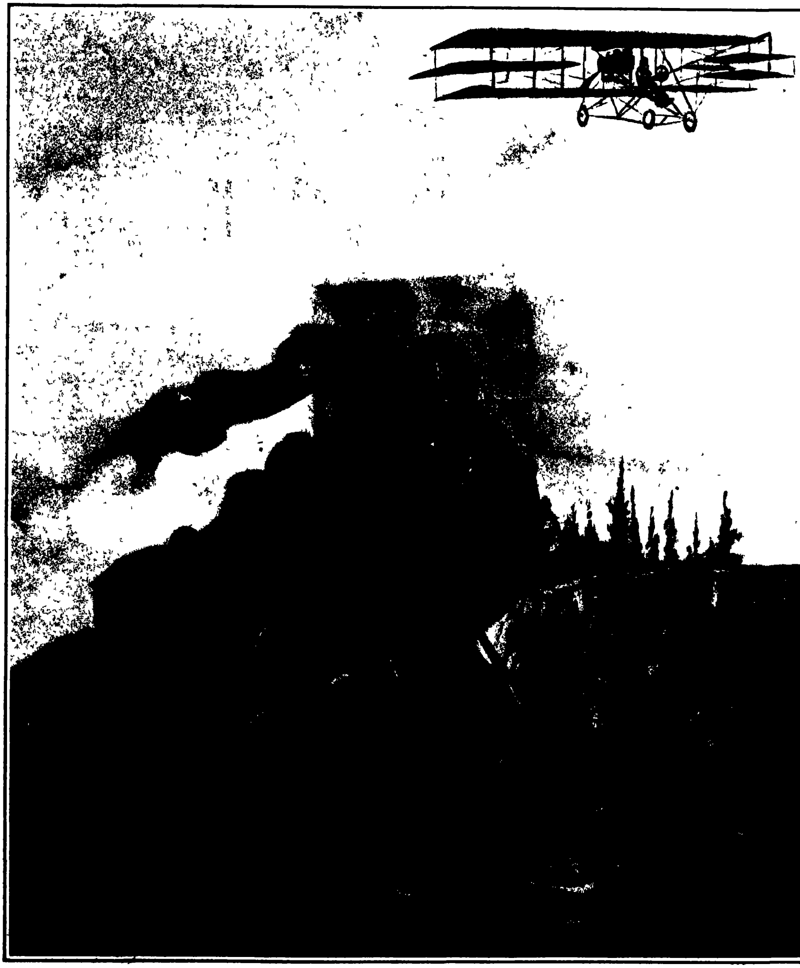

Hamilton's biplane traveling above and beside the locomotive of the special train during his flight from New York to Philadelphia and return on June 13th.

THE LATEST FORM OF RACING.—[See page 521.]

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NEW YORK, SATURDAY, JUNE 25th, 1910

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE OPEN DOOR OF AVIATION

In dissolving the injunction granted in favor of the Wright brothers against Curtiss, by Judge Hazel and the similar injunction granted by Judge Hand against Paulhan the Circuit Court of Appeals has simply followed a long-established precedent in patent law. As a general rule preliminary injunctions are not countenanced in patent cases even by lower tribunals. The reason is not far to seek. Rarely indeed is infringement so clearly established that a court is justified in restraining the manufacture and use of an invention before the question of patent validity is decided. The practice is in every way commendable. If preliminary injunctions were granted without entering into the question of validity many an honest defendant's business would be crippled until after years of litigation his legal rights are clearly defined.

The hardship which *results from too great a readiness* on the part of a lower court to restrain an alleged infringer is excellently illustrated by this very injunction which the Wrights obtained against Curtiss and Paulhan. As a result of the interlocutory decrees of Judges Hand and Hazel the Wright brothers have controlled flying in this country for the last six months. Unless he filed a bond with the court, no aviator who used a machine equipped with ailerons or wing warping devices operated in conjunction with a vertical rudder could make sell or fly his apparatus *in this country. It* is far from our intention to censure the Wright brothers for the attitude which they have taken. They are in every way justified in seeking to uphold their patents and in defending rights which unestablished as they are as yet from a legal point of view are nevertheless the fruit of painstaking experiments extending over years. Probably the counsel of the Wright brothers themselves were as much astonished by the willingness of Judges Hand and Hazel to grant injunctions against Curtiss and Paulhan as the patent profession at large. Curtiss at least was a successful aviator before the Wright brothers decided to cast aside all secrecy and to show the world what manner of machine was that of whose performances they had darkly hinted. Blériot, too, had been pluckily experimenting for some time before the Wrights flew in public. Curtiss was using hinged wing tips in his earlier machines with which he made public flights antedating the open flights of the Wrights. It is astonishing that the lower court should have failed to find in these facts a sufficient conflict of evidence to deny the granting of an injunction.

With the reversal of the decision of the lower court by the Circuit Court of Appeals, the development of aviation in this country is now unhampered. Paulhan, Sommer, Blériot, De Lesseps, and the rest of that daring company of French aerial pilots, whose exploits enliven the press dispatches almost every day, are now at liberty to enter this country and fly without the fear of finding their hands and their machines tied by a sweeping injunction. Moreover, American inventors will have the opportunity of improving existing machines provided with wing warping devices, without fear of incurring a fine for contempt of court. Much as we should like to see justice done to the Wrights, we cannot but feel that the reversal of an injunction granted contrary to established precedents will be viewed with satisfaction by every aeronaut.

THE SCIENTIFIC AMERICAN AERONAUTICAL TROPHY.

APART *from the value which will attach to the* SCIENTIFIC AMERICAN aeronautical trophy as indicating that its permanent owner has in three different years made the longest flight in the United States, the trophy will possess a strong historical and sentimental interest as being absolutely the first prize of any kind offered in America for the encouragement of the art of aviation.

In this respect the trophy must forever be unique among the countless cups and prizes which will be offered in increasing numbers during the years to come. Cups which are won year by year for certain special events and pass into the permanent ownership of the winner possess a value and interest which, however great at the time, must necessarily become local and personal as the years go by, but a trophy which carries the distinction of being the first to be offered in that early period of doubt and struggle which marks the inception of a great and difficult art such as that of flight through the air must ever possess a value all its own, which will inevitably increase with the lapse of time.

In this connection, we wish to draw the attention of entrants for the forthcoming long-distance, cross-country flights, for which such generous prizes have been offered, to the fact that upon their sending a letter of notification to the Aero Club of America their flights will receive official recognition, and if the distance covered should be greater than the seventy to seventy-five miles *(official distance now under consideration)* flown by Mr. Curtiss between Albany and Poughkeepsie, that contestant, unless his record should be surpassed before the close of the year, will be the winner of the cup for the year 1910. There is no entrance fee or expense of any kind attached to such an entry, the sending of a letter similar to that by Mr. Curtiss which was published in the SCIENTIFIC AMERICAN of June 11th, 1910, being all that is necessary.

We wish, moreover, to take this opportunity of correcting the rather widespread impression that the cup must be won three years in succession. As a matter *of fact there is no stipulation of this character laid* down. If a contestant wins the cup three times he [illegible], whether it is won in [illegible]derable [illegible] name [illegible]08 and [illegible] 1910, [illegible]er con[illegible]beaten [illegible]scribed [illegible] in [illegible] perma[illegible]try be [illegible]is and [illegible] would [illegible]he cup [illegible]s prize [illegible] are in [illegible] of the [illegible] are in [illegible]at the entrants [illegible] the contest marked by the keenest rivalry.

THE INTERNATIONAL UNION FOR CO-OPERATION IN SOLAR RESEARCH

IF a scientific critic were called upon to mention one of the most striking and important features of modern astronomical research it is quite likely that he would refer to the spirit of organized and practical coöperation which is manifested by observatories and astronomers. By evolving suitable plans for joint efforts to enable each institution to do the work for which by equipment and position it is best suited, and by assigning through common agreement the particular part to be played in any given campaign, increased efficiency is secured, useless duplication is prevented and the entire project under prosecution can be advanced symmetrically and rapidly. The photographic charting of the heavens, the observation of *transits* and total solar eclipses, *the study* of the variation of latitude, and the investigation of the shape and mass of the earth, are a few familiar instances of valuable coöperative effort by astronomers.

More recently there has been an attempt to secure a similar harmony of effort and coöperation in the study of the sun, and in 1904 at the initiative of Prof. George E. Hale, director of the Mount Wilson Solar Observatory of the Carnegie Institution of Washington, there was formed among the visiting astronomers at the St. Louis Exposition an International Union for Coöperation in Solar Research. In the following year this Union met at Oxford, and in 1907 at the observatory of Meudon in France. This year, on August 29th, the members of the International Union will assemble at Mount Wilson, California, as the guests of Prof. Hale and the Solar Observatory of the Carnegie Institution. This meeting should prove unique and memorable, for it may be doubted whether there have ever been assembled so many eminent astronomers and astrophysicists interested in solar studies as those who have accepted the invitation for the Mount Wilson conference. That such a gathering is largely an appreciation of the important services to astronomical science of Prof. Hale and the observatory under his direction will be generally admitted, but at the same time these distinguished astronomers and physicists will be able to examine for themselves this interesting institution and its novel and powerful instruments by means of which several new chapters in our knowledge of solar phenomena have been written and still other discoveries, especially in the field of stellar evolution, seem destined to follow.

To most of the visiting scientists who never before have made the pilgrimage from Pasadena up the slopes of Mount Wilson the work of the Solar Observatory is familiar from accounts published in scientific periodicals. No one is more welcome before European astronomical societies than its distinguished director, who whenever abroad is always called upon to describe its progress. Therefore, it is not surprising that when the opportunity was afforded, some fifty representatives of important astronomical observatories and physical laboratories should decide to cross the Atlantic Ocean and the American continent to see and learn at first hand of work in which they are intimately interested. While it is a source of intense gratification to Americans that the Mount Wilson Observatory has become so pre-eminent in the brief space of some six years, yet it must be remembered that solar astronomy and astrophysics are prosecuted with vigor at other institutions and by numerous astronomers. It is this circumstance that makes of importance the coming meeting of the International Union.

The value of solar work may be appreciated when it is stated that the dry season at Kodaikanal in Southern India, where there is maintained a large observatory, corresponds with the rainy season at Mount Wilson when of course the regular daily photographing of the sun is out of the question. With proper arrangements therefore, it is possible to obtain a continuous photographic record of solar phenomena from one station or another on the earth's surface. Likewise the visual observation of the sun-spot spectra is definitely apportioned among various observers, so that each group receives a portion of the spectrum for thorough study, the results of the various observations being recorded on a common plan. Again, so important in modern solar research has become the use of spectroheliograph whereby the sun's surface or limb is photographed in light of a single wave-length, according to certain definite arrangements, that there is now an important chain of observatories from India across Europe and America to the Pacific Coast, where these instruments are in daily use. To record the amount of the sun's radiation received at the earth's surface, bolometers and other heat measuring devices are employed at various stations and continuous records are kept. In many cases it is quite obvious that local conditions may affect the observations and the records. Accordingly there must be simultaneous observations at a number of stations extending over as long periods of time as possible. These are being secured with ever greater efficiency by the members of the International Union for Coöperation in Solar Research. Such coöperative action is not intended to destroy initiative or originality in any observatory or astronomer, but rather to encourage it. To-day a large number of observers are engaged actively in solar research, and in no department of astronomy is a greater amount of progress being made. This is all the more striking as it was only a few years ago, to use Dr. E. E. Barnard's picturesque expression, that "the sun had almost been relegated to that limbo from which nothing new can ever come."

Some interesting communications relating to the general study of the earth were presented to the International Geodetic Association, which met in London in September, 1909. The values of the oblateness and the equatorial diameter which have been deduced from the triangulation established by the U. S. Coast and Geodetic Survey agree closely with the values obtained from European surveys. Prof. Eotvos exhibited a torsion balance which registers variations of the force of gravity more rapidly than the pendulum, and with equal accuracy. The experiments made by Dr. Hecker in the Indian Ocean confirm the generality of isostasis, i. e., increased density of the crust of the earth beneath depressions of the surface. Major Coningham has discovered one belt of more than normal density, lying beneath the Himalayas, and a second parallel belt south of that range. Hecker has also succeeded in protecting a horizontal pendulum from temperature variations sufficiently to detect an exceedingly small variation in gravity, having a period equal to one-half of a lunar day. The variation attains two-thirds of its theoretical amplitude and gives the earth, as a whole, a rigidity comparable with that of steel. The resistance to deformation is greater in an east and west than in a north and south direction. This difference is probably caused by the earth's rotation.

ENGINEERING.

[illegible] had placed a submarine bell off the Lizard. It is suspended from a heavy tripod, which was lowered to the bed of the ocean at a point about two miles from land. The bell is connected by cable with the lighthouse, from which it will be operated. It is anticipated that, since steamers passing up the Channel all approach the Lizard, the bell will be of great assistance to them, particularly in time of fog.

Very gratifying is the steady growth in efficiency of the successive submarines which are being tried out for the United States navy The "Salmon," built at the Fore River yards and designed for 11 knots at the surface and 10 knots submerged, established last month a surface record of 13¾ knots, and a record below the surface of 12 3/10 knots. Four torpedoes, discharged when the ship was at full speed in the submerged condition, scored what was practically a series of bulls-eyes.

It is reported by the Engineering Agency of South Africa, Johannesburg, that an important body of iron ore has been found in Natal, within thirty miles of the railway and within seventy five miles of the coast. Limestone has been located in large quantities at a distance of only a mile from the ore body, and coking coal has also been discovered in Natal In view of the fact that the River Tugela, which is suitable for the development of hydro-electric power, runs through the iron ore property, it is likely that the new find will be turned to immediate commercial account.

The removal of the twelve-year-old, 20-story Gillender Building at Wall and Nassau Streets in this city is certainly a record in house-wrecking. The time allowed was 45 days at a price of $50,000, with a penalty of $500 for every day exceeding that period. The work will be done within the specified time. The most difficult work has been the removal of the brick backing of the outside stone work The steel frame was taken down, piece by piece, by knocking off the heads of the rivets and driving the latter out with a drift pin The steel work will be available for other construction.

The system of transmitting train orders in this country by the telephone is making rapid strides Statistics filed by the Interstate Commerce Commission show that the telephone is being used for this purpose on 295 roads in the United States, on which 26,244 miles of road are operated by this method On ten of the roads telephone dispatching covers 500 miles or more, and on five roads the distance covered exceeds 1,000 miles, this being the case on the Atchison, Topeka & Santa Fé, the Chicago, Burlington & Quincy, the Great Northern, the Illinois Central, and the Pennsylvania Railroad.

The Bergen tunnel under Jersey City Heights, through which for forty years all passenger trains on the Erie Railroad have been run, will be abandoned on July 1st for passenger service, and will be given over wholly to the movement of freight. After that date passenger trains will make use of a great open-air four-track cut, upon which the contractors have been at work for the past three years The cut, which extends for 4,400 feet through the Heights, is 58 feet wide at the bottom, and varies from 45 to 85 feet in depth. It is intersected by four tunnels, where the material has been left in place to carry the streets above, but none of these is of greater length than an ordinary train

In a recent fire test of the reinforced concrete floor of a tall building, the following excellent results were obtained. The floor panels measured 22 feet by 20 feet, center to center of the columns, and they were required to stand a test load of 200 pounds per square foot with a deflection not above three-quarters of an inch. In the test, the deflection under this load was only one-eighth of an inch With a hot fire beneath the floor, there was an increased deflection of 1½ inches. Water from a fire hose was then directed against the bottom of the now heated concrete, when the floor rose seven-eighths of an inch, leaving one and one-quarter of an inch deflection. This test, it should be understood, was made of a floor in the completed building.

The New York, New Haven and Hartford Railroad have received from the Westinghouse Company a new single-phase electric locomotive for the high-speed passenger service between New York and Stamford, which is of double the capacity of those already in service on the New Haven road. The specifications called for a locomotive which could haul a 1,500-ton freight train at a speed of 35 miles an hour on level track, where the train resistance was not more than 6 pounds per ton. The locomotive was also to be capable of hauling an 800-ton passenger train at a speed of 45 miles per hour. In the tests, it hauled [illegible] a heavy freight engine and a caboose, were [illegible] from New Rochelle to Stamford, a distance of [illegible] the maximum speed [illegible]

ELECTRICITY.

It has been proposed that the surplus water from the canal locks at Lockport be utilized to generate current which may be employed in lighting the Erie Canal from the Tonawandas to Albion Surely the advantages such a system would offer would well repay the cost of installation and maintenance.

An electric cable has been laid in Oneida Lake connecting Frenchman's Island with the mainland The distance is a little over a mile. The cable is to conduct current at 6,600 volts to the island, where it will be stepped down to 110 volts to be used for lighting the pavilions and amusement apparatus of the resort. This is said to be the first long-distance, high-tension submarine cable ever laid

The United States Senate has passed the bill introduced by Senator Depew governing wireless telegraphy It requires that all wireless stations secure licenses from the Department of Commerce and Labor The bill aims to prevent interference of messages and the sending of false distress signals and gives the army and navy messages the priority over commercial messages.

For some years wireless telegraph experiments have been conducted by Dr Frederick H Millener for the Union Pacific Railroad It is stated that the road is soon to establish a wireless telegraph system of communication with moving trains. Tall towers are to be erected at Sydney and Cheyenne, which will have a wide radius of communication. The system should be invaluable in the case of the interruption of wire service by storms.

Illustrative of the rapid improvement in metal lamp filaments is the recent decision of the Chicago Railway Company to install tantalum lamps on all new cars and cars that have to be rebuilt Before arriving at this decision, a series of tests was conducted, extending over a period of six months. Lamps were installed on cars in regular service and accurate records were kept which demonstrated their efficiency for this class of work.

The [illegible] appointed a [illegible] living. Among [illegible] ence [illegible] States [illegible] cases [illegible] Boston [illegible] per [illegible] pr[illegible] no [illegible] per [illegible]

A[illegible] Li[illegible] on [illegible] rule[illegible] 150 vo[illegible] mittee ha[illegible] voltage sh[illegible] large n[illegible] the danger of a breakdown of transformers [illegible] short circuiting of high potential lines would be greater than the chance of a shock from secondary of 240 to 300 volts. For this reason, the recommendation regarding circuits of more than 150 volts was withdrawn

Now that the thunder storm season is here, the Denver City Tramway Company is instructing its employes in the safest method of running their cars during a storm. The motormen are ordered to let the cars coast as much as possible, so that in case of being struck by lightning, the vital apparatus of the car would not be so liable to injury The motormen are also instructed to note, if possible, the position of the controller handle when the car is struck by lightning. If the current were off, the injury would probably be confined to the controller box. Otherwise it might damage the motors, or it might burn off the trolley wire at the base of the trolley pole. In the latter event, it would be necessary to have the car pushed back to the barns.

Paris time was transmitted some days ago from the Eiffel Tower by wireless telegraphy to all wireless stations and ships fitted with wireless apparatus within a radius of 2,500 and 3,000 miles. The time signals are to be continued and will be sent at midnight, and again at two minutes and four minutes after. The receipt of a signal will not enable a ship to determine its position or even its longitude, but will serve as a check on the chronometer. This test of wireless signaling for time at sea has brought up the question of the kind of error, in longitude, to which in these days of accurate navigation a ship is liable An error accumulates with the time at sea and as all ships carry at least three chronometers, there should not after a lapse of 100 days be the least doubt of a ship's longitude—that is within a few seconds—but the number of time signals scattered over the world is now so large that every steamer has the opportunity of correcting its own chronometers more frequently than is here suggested.

SCIENCE.

Prof. E. E. Barnard informs us that on June 6th he obtained a very good photograph of Halley's comet. The plate showed the tail drifting off into space, and a new one forming in a different direction

The collection of fresh-water sponges of the U S National Museum is now being critically examined by Dr Nelson Annandale, superintendent of the Indian Museum in Calcutta, who is an accepted authority on this subject. Under the title of "Description of a New Species of Spongilla from China" there has just been issued paper No. 1737 of the Proceedings of the U S National Museum In this publication Dr Annandale describes as new *Spongilla* (*Stratospongilla*) *sinensis* which appears to be allied to *Spongilla aspinosa* Potts from which however it differs in its compact structure and lack of flesh spicules This specimen was found on rocks in the canal in southern Kiang Su, near Shanghai, China The type is in the collection of the U S National Museum

Prof. Negro of the University of Boulogne, has studied the radio-activity of dew The precipitation was made on glass plates exposed in immediate contact with the soil for several hours, beginning at about eight o'clock in the evening It is interesting to note that the water vapor was deposited entirely on the surface turned toward the ground while the opposite surface was quite free from any trace of moisture. From Negro's experiments it would seem that, as in the case of snow and rain, the activity of dew disappears almost entirely in a very short time, which may be placed at not much more than half an hour The maximum radio-activity is detected not immediately after the introduction of the plates into an electro-static apparatus, but some minutes afterwards, in which respect it differs from snow and rain

In one of the Leopoldshall workings a blower of inflammable gas has been issuing at a depth of 1,500 feet, since August, 1904 The gas contains 83 6 per cent of hydrogen, 4 4 per cent of methane and 12 of other gases including neon and helium The helium greatly preponderates over the neon but the two together form about 0 17 per cent of the original gas, or nearly 1 per cent of the gas after removal of the hydrogen The German chemist E Erdmann has investigated this gas and he calculates that at least 12 cubic meters of the above gases have escaped since the blower was tapped He attributes the existence of the helium to the degradation of radium salts originally contained in the waters of the sea which furnished the deposits, and he regards the hydrogen as resulting from the radio-active decomposition of water, the equivalent oxygen having disappeared in converting ferrous into ferric salts in the carnallite

Mr. Austin Hobart Clark, an accepted authority on crinoids, has recently published two papers in the Proceedings of the U S National Museum The first of these papers, No 1740, is "On the Origin of Certain Types of Crinoid Stems" and in which he discusses the probable relationship between the column of the crinoid and the central or sur-anal plate of the echinoid, and how widely different types of columns may be reduced logically to a primitive common ancestor Among his conclusions from the evidence he presents is that the stems of the recent and most of the fossil crinoids may be derived by supposing them to be the homologue of the central plate of the crinoid echinoid ancestor which has gradually become thickened and elongated and developed transverse alternating fractures which have metamorphosed into definite articulations. The second paper No 1743 bearing the title "A New Australian Crinoid," is a description of a new species which he calls *Compsometra lacertosa* and which was obtained at Port Jackson, New South Wales, by Mr J Bracebridge Wilson in the summer of 1887-88

The late Prof Garriott, of the U S Weather Bureau, was working at the time of his recent sudden death on a very promising method of long range forecasting, based on the observation of departures from normal pressure in widely separated regions of the world Telegraphic reports of the pressure at European and Asiatic stations are received every morning in Washington, and were utilized for this purpose The study of 'correlative meteorology"—i e, the interrelations of atmospheric phenomena in parts of the world far remote from one another—is now occupying the serious attention of meteorologists in all countries, and is one of the two salient features in the recent development of their science, the other being the exploration of the atmosphere by means of kites and balloons. An international commission was recently organized, under the presidency of M Léon Teisserenc de Bort for the purpose of maintaining a world-wide telegraphic interchange of meteorological observations, so that in the future, if the plans of the commission can be realized, the forecaster will have at his disposal a daily weather map embracing the whole world, instead of a single country.

MODERN STEEL LOCK BAR PIPE CONSTRUCTION

BY FRANK C. PERKINS

In considering the use of steel pipe as compared with cast iron pipe, it should be remembered that the value of water pipe depends on carrying capacity, strength and durability as well as cost. The accompanying illustration Fig. 1, shows 48 inch lock bar pipe lying in a trench at Philadelphia, Pa., while the details of construction are noted in Fig. 2. It is held that the cost is about 5 per cent more than riveted pipe, but it has greater strength and carrying capacity.

It may be stated that this capacity depends on friction, and riveted pipe presents an obstruction at every rivet and every circular and longitudinal seam.

It is also claimed that the uniform section of the lock bar pipe without any obstruction of any kind from end to end of each length of pipe, materially reduces friction. Some engineers say the carrying capacity of lock bar pipe is from 10 to 15 per cent greater than riveted pipe or is equal to well-coated, well laid iron pipe.

Tests on 30 inch pipe at Lockport, N. Y., in 1909, showed a friction loss less than that given by Watson's Tables for cast-iron pipe. It is well known that steel pipe is materially stronger than cast iron pipe. During a cloudburst in 1903, two 48 inch riveted steel pipe lines carrying 50,000,000 gallons per day for Newark, N. J., were undermined and left unsupported for four days for over 35 feet, and in addition to the weight of the pipe and the water passing through them (about 15 tons), there were some thirty uprooted trees piled up over the pipe which supported this immense weight and pressure, without damage.

It is conceded that cast iron is brittle and treacherous at best and though apparently sound one day, may prove defective the next, and break without a moment's notice.

It is of course true that the strength of any steel pipe is equal to the strength of the joints. Single riveted joints have an efficiency of about 55 per cent, double riveted joints about 65 per cent, triple riveted double, buttstrap joints about 86 per cent, and welded joints about 90 per cent. Lock bar joints have an efficiency of 100 per cent, and have greater strength than plates themselves, as all tests result in a failure of the plate, without injury to the joint. A 42-inch diameter 7/16-inch plate lock bar pipe was tested to 1,050 pounds pressure, and the metal of the plate was stretched 4½ inches with neither injury to the lock bar joint nor the least leakage along the same. Further pressure was impossible, because of the blowing out of the riveted reinforcing pads at the inlet and the gage.

It is maintained that lock bar pipe is from 20 to 30 per cent stronger than riveted pipe and 10 per cent stronger than welded pipe, and experience has shown that the natural life of steel pipe when properly made and laid is fully equal to that of cast-iron pipe.

Without doubt the life of all metal is less than it was twenty years ago, as nowadays electrolysis, sulphurous acid, galvanic action and other agents greatly accelerate corrosion. It is therefore most difficult to compare the life of pipe laid within the last twenty years and pipe laid prior to that time, because of these constantly increasing corrosive influences.

Fig. 2.—LOCK BAR STEEL PIPE. TAPER JOINT.

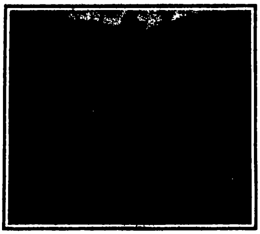


Fig. 1.—LOCK BAR PIPE 48 INCHES DIAMETER IN [illegible] PA.

According to experiments on the reception of radiotelegraphic signals when transmitting with a spark gap in compressed air, as compared with signals received when an ordinary spark gap was used, there appears to be no advantage in using compressed air for this purpose. While the dielectric strength of the air is enormously increased, so also is the resistance to the oscillatory spark, both appearing to increase in about the same ratio.

THE WEARING QU[illegible]NGANESE STEEL

Manganese steel is by no means a new material, but its application has been slow because of the difficulties which manifest themselves in giving its final form. It seems to have been discovered by Hadfield's Steel Foundry Company, Sheffield, England, some thirty or forty years ago, when seeking a hard and tough substitute for steel when used for castings. It was found that the mere increase of carbon in the steel did not have the desired effect. Steel having a carbon content as high as 2 per cent was unsuccessfully tried. It was known that when the manganese content of a steel somewhat exceeded 2.75 per cent, the alloy would be brittle. What was not known and what the Hadfield Company found out was that if the manganese were increased to a point ranging anywhere from 7 per cent to 20 per cent a steel might be produced which is remarkably strong and tough. Now this reversal of a leading property of an alloy by merely increasing the proportion of one of its constituents is, as R. A. Hadfield pointed out, not without precedent. In forming alloys of copper and tin, the resultant alloys seem to become harder and more brittle as the tin content rises from a low point up to a considerable percentage say 35 per cent, but when more tin is present than the soft and tough copper, the alloy becomes softer.

It was early found, however, that manganese steel was a very refractory metal to machine. The proper ties of hardness and toughness produced a combination that was very successful in resisting the cutting edge of the tool. And this characteristic is, even today, a bar to the application of this metal. We have high-speed steels capable of enormous performance when used against the pure carbon steels and cast iron. But manganese steels still hold out. Almost the only practicable thing to do is to use the grinder. Now the grinding machine is of late become a strong competitor of the ordinary machine tool. But its development has hardly been carried far enough to enable it to handle commercially the multiplicity of cutting operations necessary to enable manganese steel to have a general application to all the purposes for which it is highly adapted. Further, it has been found difficult to roll.

But so great are the intrinsic capabilities of this material for certain uses that, in spite of the difficulties of giving it the desired form, it has been pretty rapidly acquiring friends. Consider, for example, the case of the Boston Elevated Railway Company. This corporation operates its transportation system on a track [illegible]

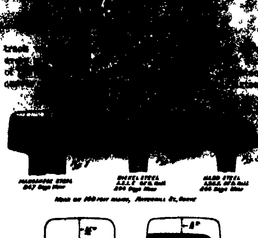
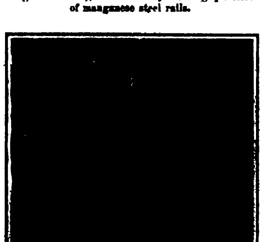


Diagram showing extraordinary wearing qualities of manganese steel rails.


This curve has the small radius of 82 feet.

THE PARK STREET CURVE OF THE BOSTON ELEVATED RAILWAY ON WHICH EXCESSIVE WEAR OF RAILS OCCURRED.

[illegible] others have radii between 100 and 150 feet. Soon after operation began, those in charge became impressed with the fact that an enormous destruction of rails was taking place on the curves. This has been ascribed largely to the sharpness of the curves, and to the combination of grades and curves. It was on the curve of the Park Street south-bound track where the ordinary rail had a life of but about 44 days. The radius here is 82 feet. At the same locality, an open-hearth rail went out of service in even less time. At Adams Square, where there is a curve of 89 feet radius, a low-carbon Bessemer, an open hearth, and a high-carbon Bessemer rail were all tried. The last was the only one which had even a moderate life—10½ months. Nickel steel was tried on a 100-foot curve at Haverhill Street. But its life was less than that of a high-carbon Bessemer rail at the same location, the two periods being 6 months 19 days and 11 months 12 days. Apparently, however, better results were obtained from nickel steel than this instance would indicate, as Mr. Steward, the roadmaster, regards the nickel-steel rails as comparing well with ordinary steel. The company tried manganese-steel rails as well. In one case, a nickel-steel rail was put in between two manganese-steel rails, with the result that after the lapse of 204 days it had to be taken out because of its failure to equal its companions. The center of the head had been worn down over ½ inch, while the corresponding position on a manganese-steel rail disclosed a reduction of but 3/16 inch. But perhaps a more striking example is that of a manganese-steel rail at the Park Street station, where the wear was the same in a period over four times as long. In fact, a manganese-steel rail laid on April 26th, 1905, showed loss from the top surface amounting to only about 9/16 inch after the lapse of 2,406 days. The accompanying engraving shows the Park Street curve.

An examination of Figs. 1 and 5 will show, however, that the edge, where the transition surface from cone to flange acted, suffered considerably. In fact, the corporation now protects the manganese-steel rail from side friction by means of a guard rail. It is probable that some, perhaps a large, part of the wear from the flange has been prevented. At any rate, Mr. Steward has expressed his opinion that the manganese-steel rail will not resist the flange action nearly so well as that of the cone.

Now, it should be observed, the manganese-steel [illegible]

(Concluded on page [illegible].)

THE CONTAGIOUS DISEASES OF METALS

THE RESEARCHES OF PROF. ERNEST COHEN

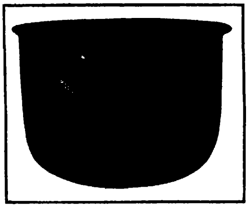
It has been known for some time, and probably even in antiquity, that metals are subject to diseased conditions. Prof. Ernest Cohen's researches have thrown considerable light on this question and have demonstrated, moreover, the contagious nature of such diseases, that is to say, a piece of diseased metal has the power of infecting, by a sort of catalytic action, a piece of sound metal with which it is in contact

TIN PEST

In 1851 Erdmann, in a communication made to the Royal Society of Sciences at Leipsic, called attention to a peculiar structural modification of tin which he had observed in some old organ pipes. He attributed the change to the vibrations to which the metal had been subjected. In 1869 Fritzsche of St. Petersburg published observations of similar phenomena, and expressed the opinion that the alteration in the nature of the tin was due to the action of severe cold to which such tin had been exposed, and verified the correctness of this theory experimentally Other investigators turned their attention to this subject, but the true nature of the modification and the exact conditions governing its appearance and development were not fully understood until they were determined by Prof. Cohen.

The disease studied by Erdmann and Fritzsche is designated by Prof Cohen as tin pest. The metal thus affected swells in spots, forming wart like blisters, from which small drops issue and hang suspended in very much the same manner that drops of quicksilver will adhere to polished copper coins In the further progress of the disease, the blisters become larger and the metallic gloss disappears more and more The interior of the mass is affected last, as can be shown by sawing through the metal whose surface has become quite dull When the entire mass has been transformed, it crumbles readily, and consists partly of a granular powder similar to sand, and partly of more or less consistent fibrous lumps of all sizes up to that of a fist. When a piece of tin is cooled artificially, the modification appears first at isolated spots, from which it spreads in wart-like blisters and later forms a columnar structure

Tin thus modified by the action of cold is distinctly gray, the application of heat produces a remarkable change. Even by merely covering it with hot water, the dark gray color is caused to become materially lighter, approaching that of ordinary tin. The change is due to the temperature exclusively. If a specimen of powdery modified tin is heated in a closed vessel by means of a water bath, it not only assumes a lighter color but decreases in volume quite perceptibly. If it is then cooled again below the freezing point of mercury, it again becomes almost as dark as it was before heating If modified, tin is heated to fusion, an appreciable proportion will remain in the oxidized state The molten portion will upon solidification assume the appearance of ordinary tin, and if cooled to a low temperature, it can be transformed

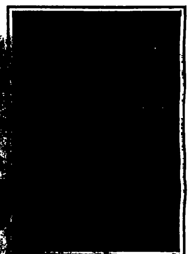


Brass kettle corroded by the wrought metal disease.

again into the gray modification Ordinary tin has a specific gravity of 7 28, but gray tin is considerably lighter, having a gravity of only 5 75

Prof Cohen directed his attention at first to determining the temperature at which ordinary tin is transformed into the gray modification, the results obtained by former investigators differing widely, some having found 35 deg (Centigrade) as the critical point, others 100 deg., etc Fritzsche's experiments indicating that the transformation was enantiotropic or reversible, it was to be expected that there would be a definite temperature at which the transformation might proceed in either direction

Antique coffee pot perforated by the tin disease.

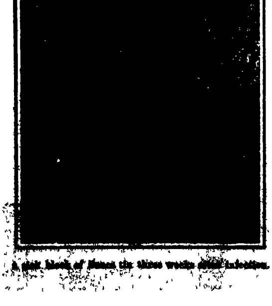


Results of inoculation with wrought metal disease.

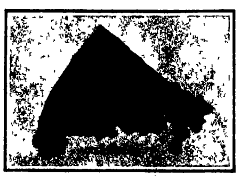
Prof Cohen employed two independent methods for determining this critical temperature One, an electrical method, consisted in bringing two separate bodies of gray tin into a vessel containing a 10 per cent solution of chlorostannate of ammonium The two bodies of tin are connected with an apparatus permitting the experimenter to observe and measure any electromotive force arising in the cell As long as both bodies are of the same temperature, there is no electromotive force. But if one of the tin bodies is given the temperature of boiling water, and the other that of cold water, the heated body is transformed into ordinary white tin, while the cooled body remains gray The electromotive force manifested under these conditions was measured at different temperatures At about 20 deg C the electromotive force was equal to zero, indicating that the critical temperature is in the neighborhood of 20 deg. C. Prof Cohen also found that the presence of the chlorostannate of ammonium solution accelerated the transformation considerably, in both directions

The other method was a volumetric one based on the fact, stated above, that the two forms of tin have different specific gravity The apparatus employed is very similar to an ordinary thermometer, except that the capillary tube is open at the top The lower part of the bulb is filled with gray tin, the upper part and a portion of the capillary tube with a liquid inert relatively to tin, such as petroleum The apparatus is heated to a temperature (say 25 deg C) a few degrees above the probable critical point, so that a portion of the gray tin is transformed into the white variety Then the apparatus is kept for some time at a constant temperature of say 21 deg C and the behavior of the petroleum column is observed by means of the scale After a few minutes it will be found to have fallen a few millimeters thus indicating that 21 deg C is still above the critical temperature, for as long as the formation of white tin continues, the mass of tin contracts in volume, owing to the greater specific gravity of white tin The temperature being then kept constant for a time say at 15 deg C, observation will show a rise of the petroleum column, thus indicating that the volume of the tin has increased by the formation of the specifically lighter gray tin, so that the critical point must be above 15 deg C By successive operations a gradual approach to the critical point is obtained by working at temperatures alternately above and below said point, and when the limits have been restricted sufficiently, interpolation is resorted to This method also showed that the critical temperature must be in the neighborhood of 20 deg C, and careful determination proved it to be almost exactly 18 deg Centigrade (about 65 deg Fahrenheit)

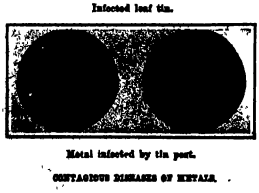
Since all tin utensils employed by us are made of the white modification, it follows that they are gen-



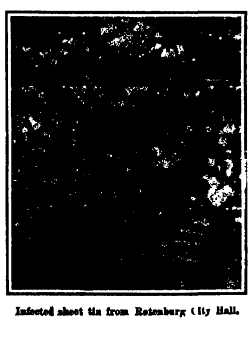
A [illegible] block of Banca tin three weeks after infection.



Infected leaf tin.



Metal infected by tin pest.



Infected sheet tin from Rotenburg City Hall.

CONTAGIOUS DISEASES OF METALS.

erally in an unstable co[illegible] and liable to be transformed partly into the gray variety, except on days when the temperature exceeds 65 deg Fahrenheit.

The second method described above was also utilized to ascertain at what temperature the transformation of white tin into gray tin proceeds with the greatest rapidity and this was found to be the case at about 48 deg. Centigrade below zero (about 54 deg F below zero)

An interesting discovery was that the transformation is hastened considerably by the presence of a few particles or "germs" of gray tin It follows that if an "infected" piece or object of white tin is left to itself at temperatures below 65 deg. Fahrenheit, the transformation will proceed constantly and with increasing rapidity, for each particle of gray tin, as soon as it is formed, becomes a new germ accelerating the transformation Prof Cohen has given this phenomenon the name of tin pest in view of the germ like or infectious action of the gray tin particles, and also in view of the fact that the tin so attacked is practically ruined, since the restoration of tin by melting is attended with great losses owing to the strong oxidation which takes place during the heating, on account of the finely divided condition of the gray tin

The formation of blisters during the conversion of the tin into the gray variety is a natural consequence of the increase of volume, since gray tin is about 25 per cent lighter than white tin

Tin articles which have been exposed to low temperatures for a long time, say several centuries, would naturally be expected to exhibit a maximum of deterioration This is indeed the case, as has been proved by the condition of antique tin vases, medals, and other objects dug up in our times In museums, too, the deterioration of tin articles has been observed frequently, but the cause was not understood and no remedy was known In the light of Prof Cohen's discoveries, the remedy is simple we have only to see to it that the articles are never exposed to a temperature below 18 deg Centigrade (65 deg Fahrenheit) Investigation has shown that in many cases where excessive and apparently unaccountable deterioration of tin articles had been reported, the articles had been exposed to low temperatures during the winter

WROUGHT METAL DISEASE

Strange phenomena were observed by R. von Hasslinger at the tinned solder seams of an air-compressor made of tinned sheet iron The solder had melted away in spots, as it were, and had assumed a crystalline structure, the tin covering of the sheet iron had become granular and dull on its entire surface. It was unlikely that the result was due to tin pest, since the compressor had seldom, if ever, been exposed to temperatures below 18 deg Centigrade R. von Hasslinger ascertained that pieces of this diseased tin would infect sound tin, and that this was apparently independent of the temperature thus indicating again that the form of tin pest previously recognized was not the cause of this newly observed transformation. The tin became crystallized in minute wart like bodies and the dull portion would spread gradually, but the rate of growth decreased with the increasing distance from the center of infection R. von Hasslinger thought that the phenomenon was due to crystallization, and continued his experiments, showing that the modified tin had a lower melting point than the original metal, about 205 deg Centigrade instead of 232 deg He also found that tin foil infected on one side would become modified on both sides Other experiments made by him, however, seemed to indicate that the crystallization theory was erroneous, and he published the result of his observations with an acknowledgment that he was unable to account for them An untimely death having prevented von Hasslinger from concluding his investigations, his teacher, Prof Guido Goldschmiedt, of Prague, drew Prof Cohen's attention to the unexplained phenomena and suggested that he continue the research

Prof Cohen repeated von Hasslinger's experiments and verified them in many ways He ascertained that the small lead contents of the tin would in no way be held responsible for the result. He first believed that the phenomena might be explained by the formation of the rhombic modification of tin which is unstable at temperatures below 161 deg C, having a tendency to resume the normal tetragonal form If this hypothesis had been correct, the phenomena should have been absent at temperatures of 161 deg. C. and above Experiments, however, showed that the transformation into the new dull powdery form of tin took place at 184 deg. C even more rapidly than at lower temperatures. This hypothesis therefore had to be abandoned

Prof Cohen then turned to another explanation, based on two well-known facts First, that a metal which has been subjected to a tensile or to a compression strain (such metal being designated as "wrought metal" by Prof. Cohen) has an electrolytic solution pressure higher than the same metal if it has not been subjected to mechanical forces; second, that several metals, tin among others, have the property of recrystallization, that is, of exhibiting a growth of their individual crystal grains, more particularly at high temperatures.

It is well known that two specimens of "wrought metal" are seldom absolutely identical in an electrolytic sense, and "wrought metal" is in an unstable condition, having a tendency to return to the condition of "unwrought metal" This tendency, slight at ordinary temperatures, ought theoretically to be strengthened by an increase of temperature, within certain limits, and it is also to be expected that inoculation with the form most stable under the particular conditions of the case, would hasten the transformation These theoretical deductions have been fully confirmed by experiments.

Prof Cohen cleaned some plates of tinned sheet iron with hydrochloric acid and potassium chlorate. This produces, in a short time, the well-known metallic moiré effect. The surface is then washed carefully and rubbed with a fine handkerchief The plate so prepared is pressed in a vise against a highly polished plate of tinned sheet iron, and upon heating to 184 deg. C the polished plate becomes infected and acquires the property of infecting others If however both plates are highly polished, no modification will occur Another experiment consisted in applying to a moiré plate such as mentioned above, some powdered infected tin foil and on top of this, a polished plate of tinned sheet iron Heating to 100 deg. C caused the polished plate to be affected immediately, while the moiré plate remained unaltered even after 24 hours.

It follows that "wrought tin" (rolled tin, tinned sheet-iron tin foil) must be considered an unstable product, in process of recrystallization The form which is stable at ordinary temperature is the gray t[illegible] but the transformation is extremely slow at such temperatures. Within certain limits, an increase of temperature increases the rapidity of transformation Contact (inoculation) with the more stable form also accelerates the transformation [illegible]. Tinned [illegible] con- [illegible] trans- [illegible], and [illegible] form [illegible] are [illegible] the [illegible] ated [illegible] metal [illegible] it [illegible] in the [illegible] matter of [illegible] ention [illegible] to [illegible] ex- [illegible] under the particular conditions. Similar effects of corrosion were observed on brass door handles, and Prof. Cohen also thinks that "wrought metal disease" accounts for the peculiar deterioration of the rolled lead roof of a sulfuric acid factory The temperature of from 40 deg. C to 60 deg C., to which the roof had been exposed, was very favorable to the recrystallization process.

The Current Supplement.

The opening article of the current SUPPLEMENT, No 1798, describes a saw-dust compressing machine.—Recent developments of American locomotives are discussed.—Mr Leon A Hackett's excellent article on the Processes in Cotton Spinning is concluded.—Prof. J A. Ewing reviews the work of Lord Kelvin in telegraphy and navigation.—In an excellent article entitled 'Oil Field Phenomena," Mr A. Beeby Thompson gives a brief review of the mode of occurrence of petroleum and the means adopted for its search and recovery.—Mr R. T Hewlett writes on soured milk from the Metchnikoff standpoint.—Plant anesthetics is explained by S Leonard Bastin

It is reported in the Electrician that the Chicago Elevated Railway Commission is considering five plans to solve the problem of "through routes" for elevated trains in that city Thirty-eight plans were submitted to the Commission, and five of these were selected for more careful study. Mr. B. J. Arnold, who is chairman of the Commission, feels that progress has been made in narrowing down the work. It is pointed out that each of the four elevated railway companies is operating under a separate ordinance granted by the city, and that the inter-relation of the elevated lines is caused by the joint use of the "down-town" Union loop. The companies are doubtful whether they can afford to haul passengers for a greater distance than about six miles for five cents, but there is apparently a desire on the part of everybody concerned to reach a solution of the question.

Correspondence.

A CALL TO AMATEUR WIRELESS OPERATORS.

To the Editor of the SCIENTIFIC AMERICAN:

The amateurs and experimenters in wireless telegraphy in New York city and Philadelphia have started a movement to organize all the amateurs in America with a view of expressing to Congress the opinion of the organized amateurs as regards restrictive legislation. The amateurs desire that a full opportunity may be given them to express their views to Congress before any of the pending bills be enacted into law

I have been retained as counsel for this movement. If your valuable paper will publish this letter, I trust that every wireless enthusiast throughout the United States will send his name to me at my office, Hibbs Building, Washington, D. C.

GEO. HIRAM MANN.

"MECHANIPULATE."

To the Editor of the SCIENTIFIC AMERICAN:

Relative to your suggestion, regarding the new word proposed by Mr. Wood, namely, "mechanipulate," it seems to me rather complicated, and I would suggest that the more homely term, machining or machined, would be far more appropriate in the application which he suggests. E. W MOORING.

Waterbury, Conn.

[The term mechanipulate does not refer to the "machining" but to the mechanical handling, i e., moving, placing, centering, etc., of a piece of work. —ED.]

GIVING THE APPEARANCE OF RELIEF TO PICTURES.

To the Editor of the SCIENTIFIC AMERICAN:

A simple method of giving the appearance of relief to pictures can be seen by the experiment that if a sheet of glass with minute cylindrical fluting on a side held against a photograph, with the series of flutes vertical, be viewed through, the dispersing light gives the picture a stereographic effect of solidity.

The utility of a minutely fluted dispersing picture cover glass screen therefore can be shown, which is caused by the semicircle dispersion by the cylindrical flutes of the light that is reflected by the photograph. The determining factors are the minuteness of the fluting and the position and the thinness of the viewing screen

The dispersion of the light by the refraction through these adjoining flutes of this stereoscopic screen presents to each eye a different appropriate view of the picture, which produces the impression of solidity and depth. A F WOOD CHENOWETH

London, England

Scientific American Prizes for Inventors.

The SCIENTIFIC AMERICAN offers $100 in three prizes, to be awarded to the inventor who gives the best account of how he conceived his invention, how he developed it in actual practice, and how he succeeded in selling it. This sum of $100 to be distributed as follows $50 to the best account, $35 to the second best account, $15 to the third best account.

There is no limitation as to subject matter of the invention. In other words, the invention may be a household utensil, a game, a piece of electrical apparatus, an improvement in railway construction, a metallurgical process, etc The following conditions, however, must be observed

1 The invention must be patented.

2. The inventor must have actually sold his patent, and the invention must have been commercially introduced.

3 The account of the inventor's success must not be longer than 800 words.

4 The composition, letter, or article must be typewritten on one side of the paper only

5 The inventor must sign his offering with a pseudonym, and inclose it in a sealed envelope, upon which the pseudonym is written. A second sealed envelope must be provided, bearing on the outside the pseudonym under which the offering is submitted, and containing the real name and address of the contestant.

6 Contestants must address their offerings to Inventors' Prize Editor, SCIENTIFIC AMERICAN, 361 Broadway, New York city.

7. The contest remains open until August [illegible]. The Judges will select the essays which, in their opinion, have won the three prizes and give them to the [illegible] of the SCIENTIFIC AMERICAN, who will [illegible] the sealed envelopes containing the true names of the contestants, and notify the winners of [illegible].

8. The Editor of the [illegible] right to publish [illegible] as well as those which [illegible].

9. [illegible] therefore [illegible] of their [illegible].

[illegible] Independence Day [illegible]

[illegible]

[illegible] columns of the issue of July 3rd, 1909, [illegible] the title "Tetanus and the Glorious Fourth," I [illegible] data regarding the dreadful injuries and [illegible] suffered year after year by our children and [illegible] because of the methods with which for a century [illegible] our people have been celebrating Independ[illegible] Day. I pointed out that the greatest danger lay [illegible] tetanus or lockjaw; and that most of the cases of "[illegible] of July tetanus" have come about through [illegible] of blank cartridges in toy pistols and of giant [illegible].

I dwelt upon the tetanus bacillus, the germ responsi[illegible] for this disease, which is introduced, in impreg[illegible] dirt, into wounds—sometimes very slight in [illegible] the face, hands, and feet. I noted that the [illegible] period of tetanus (while the toxins gene[illegible] the bacillus are disseminating in the blood, [illegible] the dreadful symptoms develop) is from [illegible] to a fortnight, that prophylactic injections [illegible] tetanus serum, if given immediately after the [illegible] will almost certainly ward off this disease, [illegible] before its introduction was fatal in more than [illegible] of the cases; that practically all health de[illegible] are now open on Independence Day, pre[illegible] to provide this antitoxin, when asked for it by telephone; that in the event of any wound, immediate [illegible] heroic surgery is imperative, and that if any [illegible] wound be examined under the microscope for [illegible], the latter's absence after several exami[illegible] should greatly allay fear of the disease de[illegible].

[illegible] several years past humane citizens, anxious [illegible] prevent these deaths and sufferings among our [illegible] people, have striven to interest public opinion [illegible] the substitution of celebrations of the great na[illegible] holiday every whit as patriotic, while at the same time much safer and saner, and at least as con[illegible] to pleasure and patriotism as those that have hitherto obtained, and year by year the success of [illegible] endeavors has been progressive. I would here [illegible] what has been done in these premises during [illegible] last twelvemonth.

[illegible] year Independence Day fell on Sunday—the [illegible] reason, no doubt, why the number of tetanus [illegible], which had theretofore been steadily decreasing, doubled in 1909 those of the preceding year. The coming holiday falls on Monday, so that the festivi[illegible] are likely again to be spread over three days. There seems moreover to have been relaxed authority regarding the use of fireworks, especially in Illinois, Massachusetts, New Jersey, New York, and Pennsylvania; this relaxation regarding especially the use of blank cartridges resulted in an increase of [illegible] cases. Nevertheless, last year there was gratifying evidence of an increased public sentiment in favor of more rational celebrations. Two cities, Washington and Cleveland, joined those which had already passed prohibitory ordinances, and Chicago enforced a restrictive ordinance, with the result that no casualties were reported from Washington, only four slight injuries for Cleveland, and less than half the usual number of accidents—with no deaths—for Chicago, although this latter city had 12 deaths in 1908 and 16 in 1907. Prohibitive ordinances have been more effective than restrictive ordinances, the latter in turn are much better than the do-nothing policy.

As I have intimated, year by year efforts have been progressively making to substitute sensible amusements and enthusiasms for the explosive celebrations that have resulted in 794 tetanus deaths among our children in seven years. Springfield, Mass., while abating not a jot—indeed, rather enhancing—a spirit of genuine patriotism, has provided parades, floats representing historic incidents, picnics; and, finest of all, an annual chorus drilled by skilled leaders in the mass singing of national airs and popular songs. How worthy of emulation by other communities! How gratifying to all but the "business interests" involved!

The Journal of the American Medical Association has for seven years past demonstrated by statistics the appalling number and character of the casualties resulting from our wonted celebrations. As I have noted, blank cartridges alone furnished 794 tetanus deaths in those years; and the disease of which these children and youths—all under eighteen—are the victims is the most agonizing known to medical science. The deliberate tortures of the Inquisition hardly paralleled such sufferings. If, in the face of these undoubted facts, it will be decided to adhere to the old order of things, far more merciful would it be to pick out a hundred or more youths the coming Fourth and deliberately shoot them in any market place. [illegible]

All classes of publications are taking up the propaganda begun by the American Medical Association; newspapers and magazines are utilizing the statistics which its Journal has submitted. One magazine imagines the results of a vote by Congress to sacrifice each year one unknown boy as a national Fourth of-July offering—the newspaper extras announcing the grotesque and extraordinary action, editorial denunciations of our law-makers, the public agitation and supreme indignation, petitions to Congress and the President, the tumult that would inevitably attend the execution of such an act of madness. Yet we have supinely been allowing, year after year, with the absolute certainty of the result before us, the slaughter of hundreds and the mutilation of thousands of our children, with the natural consequence in suffering, torture of mind, and desolation in many households.

Our people are indeed well on the way to grasping the logic of these presentments. Everywhere individuals, civic societies, and kindred organizations are at work, measures are on for the formation of a national committee to promote a "safe and sane Fourth", municipal authorities are acting understandingly, to legislation hitherto enacted, more has been or will be added this year. The action of the Medical Society of the State of Pennsylvania is especially noteworthy by reason of its comprehensive character. Its Committee on Independence Day Fatalities recommends Legal control of the importation, manufacture, and sale of explosives used only for purposes of celebration; municipal control of the use of firearms and of fireworks during the Fourth-of July season, municipal participation in substitution methods, the organization of societies for both control and substitution purposes, the most complete possible systematic use of tetanus antitoxin, and other medical measures in both the [illegible] of tetanus and sepsis (blood poisoning) [illegible] schools [illegible] of the [illegible] possib[illegible] matte[illegible] Indep[illegible] the a[illegible]

In [illegible] manif[illegible] been [illegible] parad[illegible] from [illegible] police [illegible] would [illegible] on th[illegible] and [illegible] and [illegible] the [illegible] work[illegible]

[illegible]

th[illegible] Indianapolis [illegible] the [illegible] mile [illegible] for the aeroplanes [illegible] was [illegible] with [illegible] Orville Wright [illegible] 1[illegible] circling twice around [illegible] course and executing some graceful maneuvers [illegible] sharp turns and sudden dips. Walter Brookins, one of the five aviators Orville Wright trained recently at Montgomery, Ala., is reported to have made four laps of the course (4 miles) in [illegible] minutes or at the rate of [illegible] 3-4 miles an hour.

Subsequently Mr. [illegible] made a new height record [illegible] circling [illegible] height of [illegible] 384 [illegible] feet [illegible] according to the observers [illegible] taking the height, he attained an altitude of 1 900 feet in 7 minutes. It took him a half hour to reach the greatest height. He descended in circles the same as when he ascended, and when within a hundred feet of the ground, he shut off the motor and glided to earth. The following day Brookins continued his exhibition flights and gave another demonstration of his skill as an aviator by flying for nearly an hour in a stiff wind. After doing many fancy maneuvers he made a glide and landed almost at the starting point. One of the other Wright machines had trouble with its motor and was unable to make more than a half circuit of the course. There was very little flying this day on account of the wind.

The third day of the meet Brookins again attempted to make an altitude record, but only succeeded in reaching a height of a little over 1,700 feet. After the usual performance of the five Wright biplanes, Orville Wright made a flight in which he performed numerous and daring evolutions over the trees in the surrounding fields. His machine flew very steadily and made sharp turns, but did not show the speed that Hamilton exhibited in his Curtiss biplane at Mineola.

On the fourth day of the meet aviator Brookins well nigh outdid Orville Wright in the fancy maneuvers he executed and in the sharp turns he made. He created a new world's record for turning by making two turns in 6 2-5 and 6 1-5 seconds respectively. The circle he described was less than 150 feet in diameter. The best previous record of this character is said to have been made by one of the Wrights recently at Dayton. Brookins again attempted to break his altitude record, but only succeeded in reaching 3 800 feet after a 45-minute ascent. He required only 10 minutes to descend from this height. Two and three aeroplanes were frequently flying together during the afternoon, and at one time the motor in aviator Hoxsey's Wright machine suddenly stopped when he was at a height of 200 feet. He glided down in a straight line and landed in a field quite a distance away.

On the fifth day, Brookins again attempted, and this time successfully, to break his altitude record. After soaring in wide circles for 40 minutes, he reached a height of 4,503 feet. The machine was but a speck in the sky and on account of the haze and the lateness of the hour, it was sometimes momentarily lost to view. After apparently hovering for several minutes, he began a slow descent in wide circles. Brookins circled five miles to the east of the motor speedway and gradually closed in upon it. He had difficulty in seeing the track because of the gathering darkness. The motor stopped when he was only half way down and he was obliged to make a long glide. He finally landed in a farmer's yard a couple of miles from his starting point. The flight had lasted an hour and a half, and it was by all odds the best attempt at high flying that has yet been made.

The Indianapolis aviation meet did not draw the crowds anticipated. This was doubtless due to the fact that only one make of aeroplane was used. In order to have a good sporting event, various types of machines must compete. At the meeting in Montreal, from the 25th inst. to July 4th, there will be two Blériot monoplanes, in addition to the five Wright [illegible] and the biplane of J A D McCurdy. There [illegible] be some other machines entered at the last [illegible]. Count Jacques de Lesseps, who recently [illegible] across the English Channel, will pilot one of the [illegible] monoplanes. This machine has a 50-horse power [illegible] and will be able to outdistance the Wright bi[illegible], which have only 30-horse power engines. In all [illegible] there will be some interesting races at [illegible] international meet.

[illegible] Information About Dishonest Patent Schemes.

[illegible] Scientific American has always made a prac[illegible] of exposing the snares and devices of the patent [illegible] promoter, as well as the fraudulent patent attorney [illegible] the subject is by no means new to the read[illegible] of the Scientific American, it is one of which all [illegible] inventors should be thoroughly informed. The Editor [illegible] the Scientific American would like to receive from [illegible] readers of this journal, letters in which they narrate [illegible] their personal experiences with dishonest promoters [illegible] attorneys. Such letters will be published in due [illegible] course, and should not only be of interest in them[illegible] selves, but should serve as a warning, thereby protecting others against such snares.

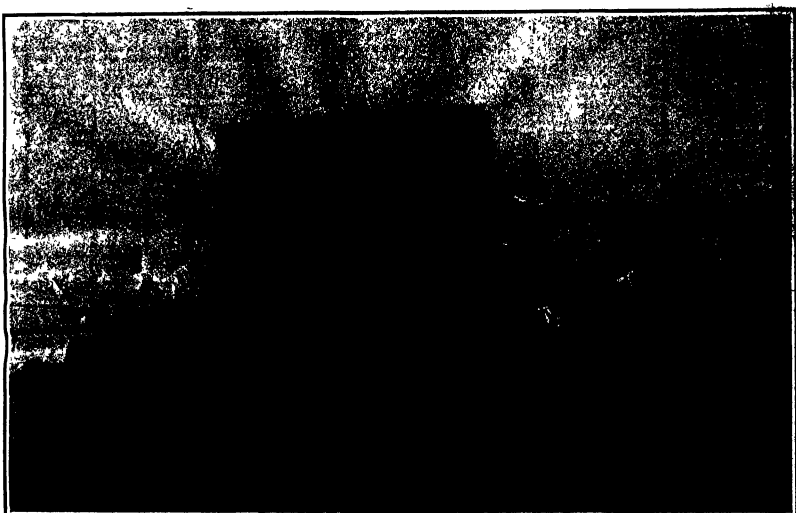
The staff of the Bureau of American Ethnology of the Smithsonian Institution has recently been increased by the addition of two ethnologists who have come to their work with the prestige of high university distinction. The first of these, Dr. Truman Michelson, studied comparative philology at Harvard, and then continued his studies abroad at the universities in Leipsic and Bonn. He then taught comparative philology at the University of Missouri in Columbia, and more recently has been a student under Boas at Columbia University in New York city. He has published various papers in his specialty, and has in press a revision of Jones's "Grammar of the Fox Language." Dr. Michelson will undertake to determine the linguistic interrelationship of the greater groups of the Algonquian languages. For this purpose he will visit during the summer the Blackfeet reservation and the Northern Cheyenne reservation in Montana, then the Windriver in Wyoming, and Menomoni reservation in Wisconsin, and the Micmac reservations in Quebec and New Brunswick. The other of these new appointees is Mr. Paul Radin, who has prosecuted advanced studies in anthropology at the universities in Berlin and Munich, and during the last four years has been a student under Boas and Farrand at Columbia University in New York city, from which institution he is soon to receive his doctorate. Mr. Radin has taught at the College of the City of New York, but has decided to relinquish teaching in order to follow ethnological studies as a life work, and to him the Bureau has assigned special investigations among the Winnebago Indians of Nebraska. Mr. Radin is the author of numerous papers which have appeared in the Zeitschrift für Ethnologie, the Journal of American Folk lore, and the Proceedings of the Royal Anthropological Institute of Great Britain and Ireland.

THE GERMAN DREADNOUGHT "NASSAU"

THE FIRST OF THE GERMAN FLEET OF DREADNOUGHTS TO BE COMPLETED

In view of the great secrecy which has attended the construction of the "Nassau," the type ship of the fleet of German dreadnoughts some surprise was expressed upon the first public view of the ship, that she possessed, as a dreadnought, no features of marked novelty. To the people of the United States, there is something familiar about the arrangement of her main battery, with its armament of heavy guns carried in six turrets, one forward and one aft of the center line, and four arranged amidships quadrilaterally. Their thoughts will be carried back some twenty years to the time when the plans of our first battleships "Oregon," "Massachusetts," and "Indiana" were made public. The distinctive feature in these vessels was the heavy battery which they carried and the novel plan upon which it was disposed, the pairs of 13-inch guns being carried in turrets forward and aft and the pairs of 8-inch guns being mounted in four turrets two on either beam, arranged at the four corners of the superstructure. This, it will be observed is practically the plan followed in the ships of our own navy, the guns are all mounted upon the longitudinal axis of the ship, and consequently the whole power of the 12-inch battery can be brought to bear on the broadside throughout a wide arc of training.

In justification of their adoption of the quadrilateral system of mounting, the Germans announce their conviction that in the engagements of the future there will be more fighting in the end-on or quartering position than the advocates of the all-centerline system of mounting believe, and they emphasize the fact that the "Nassau" can not only concentrate six heavy guns in the end-on position, but that she could deliver this heavy fire, should the exigencies of an engagement demand it, both forward and astern at the same time. Furthermore, there is a certain advantage in the fact that two guns and four turrets are held in reserve on the lee side and are greatly protected by the turrets which are in engagement on what might be called the weather fighting side of the ship.



Length, [illegible] feet. Beam, 89 feet. Draft, 26½ feet. Displacement, [illegible] tons. Normal coal supply, [illegible] tons. Armor: Belt, 11 inches; turret and barbettes, 11 inches. Armament: Twelve 11-inch, [illegible] guns; twelve [illegible] guns; sixteen [illegible] guns.

"NASSAU"—FIRST OF THE GERMAN DREADNOUGHTS.

"Nassau" Incidentally, it may be mentioned that the Japanese have adopted the same arrangement in the first dreadnoughts built for their navy.

Obviously, the principal disadvantage of the system is that the ship, although she mounts twelve heavy guns, can bring only eight of them to bear upon either broadside, at least four guns being masked by the superstructure or by the other turrets while she is fighting a broadside engagement with the enemy. In Should the weather guns be disabled, it would be possible for the fleet to make a complete turn of 180 degrees, and bring four big guns, with their gun crews entirely fresh, into the fight.

To these arguments it will be answered that, by moving one of the four amidship turrets forward and placing it at a sufficient height to fire above the foremost turret, and removing another of the turrets aft and giving it a similar relation to the aftermost turret, not only would the broadside fire of the "Nassau" be increased from 8 to 12 heavy guns, but the end-on fire would be strengthened by the addition of two more guns, raising it from a concentration of six to one of eight guns. This is the method adopted in the new Argentine cruisers, the most powerful dreadnoughts now under construction, which will be able to fire eight guns ahead or eight astern, or twelve on either broadside.

However, in estimating the merits of warship design, we must be careful to bear in mind the question of displacement, which in the "Nassau" stands at the very moderate figure of 18,500 tons; and, if we remember that our latest dreadnoughts have run up to 26,000 tons, it must surely be admitted that the Germans, in view of the limited displacement of the "Nassau," have turned out a decidedly compact ship.

The following dimensions, which have been obtained through the courtesy of the German Navy Department, may be taken as correct: Length, 452 feet, beam, 89 feet, draft, 26½ feet; displacement, 18,500 tons; normal coal supply, 950 tons. The "Nassau" is driven by triple engines, and on her trials considerably exceeded her contract speed of 19 knots and may be set down as a 20-knot vessel. The armament consists of twelve 11-inch, twelve 6-inch, and sixteen 3.4-inch guns. She is protected by eleven inches of Krupp armor on the belt and the barbettes and turrets, and twelve inches on the conning-tower.

An English Judicial Opinion of Complex Patents.

The complexity of patent specification phraseology, and particularly the bewildering character of the claims of an American patent, were recently made the subject of a decision of the House of Lords. The case, which five members of the House were called upon to decide, was that of Linotype and Machinery Limited vs. Hopkins. We presume that the specification, which called forth the condemnation of the Lords, was simply the American specification filed in England without any change. The following is an extract from the decision, the unanimous judgment of the five members of the House of Lords:

"The appellant (i. e., the patentees) has filed a specification which resembles a treatise in its length; it contains no less than sixty claims; there is infinite redundancy and repetition and constant reference to illustrations which are not very easy to follow. Altogether it is a document which needs the most prolonged and penetrating study in order that anyone, who wishes to work out problems of invention in this class of industry, may know where they stand and how they may be free from the danger of infringing former patents.

"The point whether this patent is good or not does not arise in this case, but I think it is my duty to state explicitly that those who file and secure specifications must take the risk of having the whole thing declared void for ambiguity. I have had occasion to observe that there is a tendency to frame specifications and claims so as to puzzle a student, and to frighten men of business into taking out a license for fear that their interpretation may be held erroneous, and they be found guilty of infringement. That is an abuse of the law and will be checked if occasion should require, by the simple process of declaring the patent invalid."

Uranium is found commercially in only two minerals in the United States, pitchblende and carnotite. Pitchblende, which is widely known because of its use as an [illegible], occurs commercially in the United States only in Gilpin County, Colorado, where there are four mines that produce it. Carnotite occurs as a yellow powder in [illegible] in Utah and Colorado.

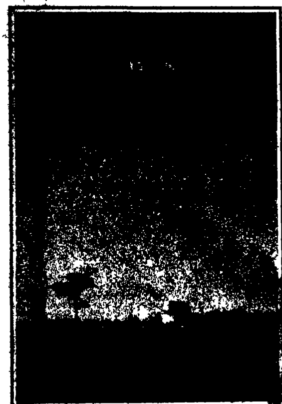
Hamilton's Round-Trip Aeroplane Flight from New York to Philadelphia

A REMARKABLE CROSS-COUNTRY FLIGHT

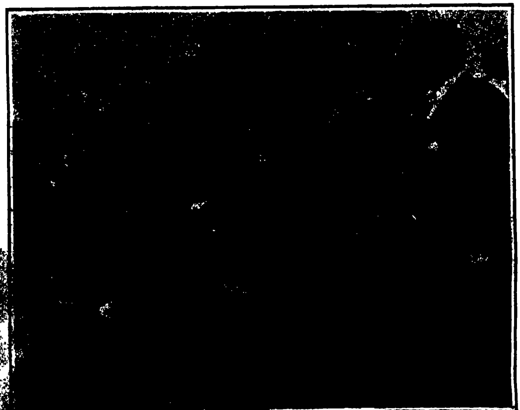
Only a few days after Glenn H. Curtiss's flight from Albany to New York, aviator Charles K. Hamilton made a more daring and thrilling flight from New York to Philadelphia. This second flight was planned by the New York Times and the Philadelphia Public Ledger and aviator Hamilton, carrying a letter from Mayor Gaynor of New York to Governor Stuart of Pennsylvania, executed the flight on schedule time During a considerable part of the trip he raced a special train which at times found difficulty in keeping up with him.

The start was made from Governor's Island at 7 36 A M on Monday, June 13th The actual start took place only after Hamilton had broken a propeller in attempting to start the first time, due to the blade striking a stick that lay upon the ground As soon as he had substituted a new propeller—the very one used

(*Continued on page 527.*)



Walter Brookins flying at the Indianapolis meet.
Brookins made a new height record of 4,504 feet.
For description see page 519.



...message to Gov. Stuart upon his ...ladelphia.

Hamilton flying above the Pennsylvania Railroad tracks in pursuit of the special train.

HAMILTON'S ROUND-TRIP AEROPLANE FLIGHT FROM NEW YORK TO PHILADELPHIA.

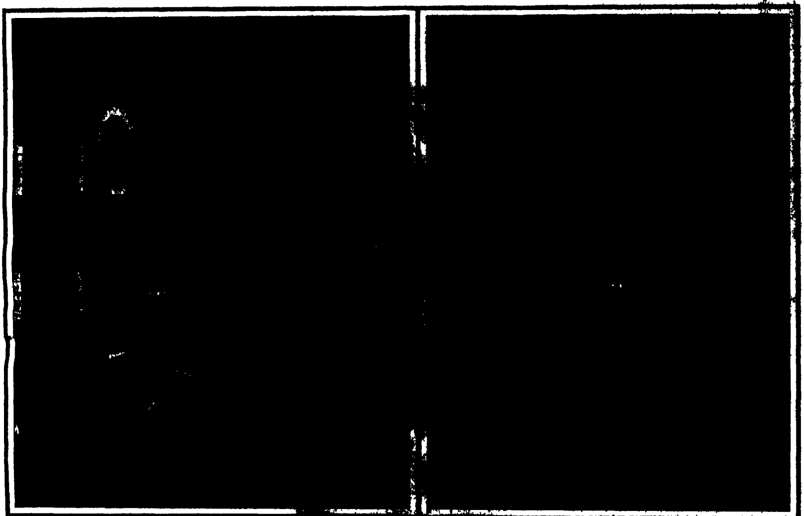
New Filtered Water Supply for the City of Pittsburg

HOW THE ALLEGHENY RIVER WATER IS PURIFIED AND DELIVERED INTO THE CITY MAINS

There has recently been completed for the city of Greater Pittsburg an ambitious scheme of pure water supply which represents the very latest developments in work of this character. The site for the filtration plant is on the north bank of the Allegheny River about seven miles above the point where it joins the Monongahela to form the Ohio. The new plant is located a short distance above and on the opposite side of the river to the Brilliant Pumping Station, which formerly took water from the river direct. The plant extends along the river front for 3,700 feet and covers some 225 acres.

At the upstream corner of the site low lift pumps located in what is known as the Ross Point Pumping Station raise the raw water to a central receiving or sedimentation basin of 20,000,000 gallons capacity. On each side of this receiving basin is a larger sedimentation basin, and the three have a combined capacity of 130,000,000 gallons. From the central receiving basin water flows to the rest of the plant by gravity gallons per 24 hours when pumping against a total head of 46 feet, of which not more than 14 feet is suction lift. The impellers of the pumps are 11 feet 3 inches in diameter. The suction nozzles are each 28 inches and the discharge nozzle is 36 inches in diameter. The external construction of these pumps is clearly shown in the accompanying illustration.

The 100-inch conduit before mentioned as conveying the raw water extends under the pump pit and forms a suction pit for the pumps, which discharge through branch connections to a 96-inch rising main that extends 1,853 feet to the central gate-house. The rising main is built of half-inch riveted steel plates surrounded by concrete. The flow of water through the rising main is measured by a 96-inch Venturi meter with a 50-inch throat—the largest meter of this type ever built. At the discharge end of this main is a central gate chamber 50 feet by 53½ feet, which controls the flow of water to and from the sedimentation basin. Above this chamber is built the administration building, from which the entire operation of the plant is controlled and directed.



One of the four huge centrifugal pumps, each of which can lift 35,000,000 gallons per day against a head of 46 feet. The two suction nozzles are 28 inches and the one discharge nozzle 36 inches in diameter. The impellers are 11 feet 3 inches in diameter.

FILTERED WATER SUPPLY FOR THE CITY OF PITTSBURG

flowing first to the sedimentation basin, and thence to the slow sand filters, from which it is conveyed to a covered filtered-water reservoir on the bank of the river. From the reservoir the water passes through two steel conduits laid under the river to the high-service Brilliant Pumping Station, which lifts the water to the storage reservoirs that supply the distribution system of the city.

The intake has been built back of a revetment which has been constructed along the river bank in front of the Ross station, and it consists of a concrete chamber to which the river water is admitted by sixteen four-foot conduits arranged in two horizontal rows of eight each. From the intake the water passes through a 124-inch conduit for a distance of 330 feet to the pumping station.

The Ross Point Station measures 129 by 200 feet in plan. The steam generating equipment consists of eight 350-horse-power horizontal Sterling water-tube boilers arranged in batteries of two each. Extending along the front of the building is a pump pit 88 feet wide and 16 feet deep. In this are placed four Allis-Chalmers horizontal-shaft single-stage double-suction centrifugal pumps, each direct connected to an Allis-Chalmers vertical cross-compound condensing Corliss engine. Each pump has a rated capacity of 35,000,000

There are three sedimentation basins, the two larger ones covering about twelve acres and the smallest about three acres. Water is carried to a depth of about fifteen feet, and the total capacity is 130,000,000 gallons, or about one day's supply. The 56 filters have each a surface of one acre and a capacity of 3,000,000 gallons per 24 hours. Each filter bed measures 163 by 263 feet, and it is completely roofed over. The floor is of concrete and the groined-arch roof is supported by 170 columns, each 22 inches square, spaced 15 feet center to center. The under drainage or collecting system consists of a central main collector extending down the central bay, with lateral collectors of vitrified tiles in each side bay laid in open joints. The collectors are covered with one foot of gravel varying from one-fourth inch to three inches in size, above which is a layer of sand four feet thick. An interesting feature is the new system for scraping the beds and cleaning and replacing the sand. The work is done by machinery instead of by hand, and the system is the most complete in this country.

The collectors beneath the filter beds lead to conduits in the galleries, and these connect with the main conduit, which leads to the filtered-water reservoir, which has a capacity of 50,000,000 [illegible] latter is built of plain concrete with [illegible] roof, the latter being carried on 775 round [illegible] inches in diameter, 21½ feet high, spaced 15 [illegible] ter to center. These arches are believed [illegible] largest of this type that have ever been b[illegible]

From the filtered-water reservoir the water [illegible] ried by two 72-inch steel pipes beneath the river [illegible] the Brilliant Pumping Station. Originally [illegible] ing station had a daily capacity of about [illegible] gallons, the plant consisting of two 10,000,000 [illegible] Holly engines and two 15,000,000, and four [illegible] gallon Allis-Chalmers vertical cross-compound [illegible] ing engines. At the time of the building [illegible] filtration plant two additional 15,000,000-gallon [illegible] Allis-Chalmers pumping engines were [illegible] grounds of the filtration plant, which occupy [illegible] acres, have been developed into a very beautiful [illegible] The filters and filtration reservoirs, which, as we have noted above, are covered, have been overlaid [illegible] eral feet of soil which has been sodded. Macadam road drives planted with trees have been laid out, and a natural wooded slope at the back of the plant has been left unchanged. The delivery of filtered water was begun early in 1908. The full capacity of the original filters was reached in [illegible], and with the construction of the last ten filters, the entire city of Greater Pittsburg will be supplied with pure drinking water. For our illustration and the particulars upon which the above article is written, we are indebted to the courtesy of the Allis-Chalmers Company and Industrial Progress.

The [illegible] ocean race from the Ambrose [illegible] to Sandy Hook for the [illegible] under the auspices of the Atlantic Yacht Club, [illegible] the minds of yachting men the famous schooner race of 1870 over the same course, between the schooner "[illegible]," challenger in that year for the "America" cup, and the American schooner "Dauntless." [illegible] Head at [illegible] on July 4th, the [illegible] Sandy Hook [illegible] minutes ahead of the [illegible] pers chose totally different [illegible] at one time by 15 degrees [illegible] 77 minutes [illegible]

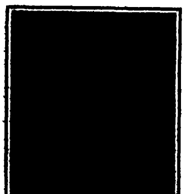
The Home Laboratory

[The Editor of the Home Laboratory will be glad to receive any suggestions for this department and will pay for them, promptly if available.]

WANDERING CHEMICALS

BY PROF GUSTAVE MICHAUD COSTA RICA STATE COLLEGE

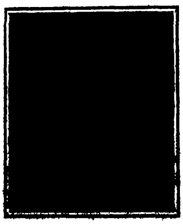
To cause two objects to change place that is, to pass from one vessel into another and vice versa is a trick sometimes done by conjurers What is new



CONTENTS OF TUBES BEFORE SHAKING

in the performance described here is the evident non-intervention of the magician and the possibility of watching the trick closely in full light The vessels used are two perfectly transparent glass test tubes Every spectator can see that they contain nothing but the two substances about to change place One of these is a fluid, transparent, colorless liquid which fills about one-half of the tube The other tube contains nothing but a white, opaque powder Both tubes are given to some skeptical spectator, with the request that they be kept well apart, one tube in each hand, and that the experimenter should remember which the liquid or solid is kept in the right or left hand The skeptical person is then ordered to close the tubes with his thumbs and to shake them After having complied with this request he will find that the two substances have apparently changed places, the tube which contained a white opaque solid now contains a colorless transparent liquid and the tube which contained a watery liquid is now filled with a white opaque perfectly solid substance

Some curious and but little known properties of organic substances are used for this performance. One of them is the property of salol to remain in the fusion state with such a tenacity (in open vessels in presence of unfiltered air) and for such a time that no other substance equals it in that respect, except perhaps the metal gallium Salol is used in medicine for some kinds of intestinal troubles and is sold at every druggist s Some ten grammes of it are placed into a clean and dry test tube care being taken not to leave crystals adhering on the walls of the tube



CONTENTS OF TUBES AFTER SHAKING

The chemical is then melted over any flame (A candle will do, as the fusion point of salol is but 42 deg Centigrade.) Once liquid, it is heated a trifle over its fusion point, so as to melt any particles of salol left [illegible] This is then allowed to cool and is [illegible] even two or three hours [illegible] Covering it to and fro will not cause [illegible]

the crystallization but vigorous shaking for about ten seconds invariably transforms the liquid into a solid white mass At the moment of the solidification the cold tube instantaneously becomes hot

The property of solid camphor to rapidly melt into a liquid compound whenever ground or shaken with solid chloral hydrate is used in the other test tube The two chemicals must be finely powdered and the camphor is sprinkled with a few drops of alcohol before being ground The two white powders look alike and are superposed in the tube two parts in volume of camphor being taken for one of chloral hydrate The shaking rapidly mixes and liquefies them

Large tubes or bottles of any thickness can be used when the experiment is made in a hall The fusion of salol is then produced in a water bath

GEISSLER TUBES FROM ELECTRIC LIGHT BULBS.

BY JAMES BAILEY

Many people have wished to perform experiments with Geissler tubes but owing to their high cost have not been able to do so

By the following simple and inexpensive method anyone who possesses a one inch or larger induction coil can make a very good substitute for a Geissler tube from any of the standard electric light bulbs Burned out lamps or lamps in which the filaments are broken give the best results and can be had for next to nothing The effect is much better if the filament is broken into fine pieces, as it then does not interfere with the discharge in the bulb Metal filaments can easily be broken by striking the lamp with the hand but in carbon lamps the filament is sometimes so tough [illegible]

[illegible] change to a pinkish glow and when just the right amount has leaked in striations will occur as in real Geissler tubes

Allowing just the right amount of air to leak in is a rather difficult process but it can be done most simply as follows

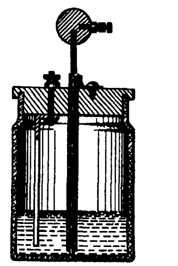
Instead of making a wax cone as in Fig I make a bell shaped piece as in Fig III With a sharp file nick the bulb where the end of the wire will come The purpose of this nick is to help the spark puncture the glass It should not be made deep enough to allow any air to enter the bulb Next stick the wax bell on the bulb so that the end of the wire rests in the nick Connect to the coil as before and turn on the current The spark will jump through the glass and whatever air is in the bell will leak into the bulb By varying the size of the bell different colored glows may be obtained The wax bell in Fig III shows about the size for the best results with 16-candle power lamps Different lamps give different results so that the exact size of the bell cannot be determined and striations are more or less a matter of luck Almost every bulb made as above will show beautiful color effects each different from the other and the results are well worth the trouble

CONSTRUCTION OF A SIMPLE ELECTROLYTIC INTERRUPTER.

BY GEORGE F WORTS

The electrolytic current interrupter described here may be used in place of the troublesome vibrator on spark coils. It is to be operated on 50 to 220 volts direct or alternating current The interruptions obtained with this type of interrupter are very high, being in the neighborhood of 1 000 per second

The electrolyte and electrodes are contained in a wet battery jar A wood plug should be turned to fit tightly in the top of the jar and boiled thoroughly in paraffin to protect it from the acid fumes A glass tube 6 inches long with an internal diameter of ¼ inch should be procured and a hole slightly larger than the external diameter of the tube bored through the center of the wood cover The tube is held in position by a heavy brass spring pressing against it For the anode a ⅛ inch round brass rod should be straight-



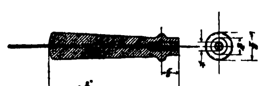
A SIMPLE ELECTROLYTIC INTERRUPTER

ened so as to slide very easily through the glass tube One end of the rod should be squared off and the other end threaded and a tapped brass ball fitted to it T is weight by gravitation feeds the rod into the solution as it is used One side of the ball should be tapped and fitted with a binding post for connecting purposes The cathode consists of a lead strip 1 by 1 by ⅛ inch suspended in the solution from a machine screw the threaded end of which terminates in a binding post for connections To assemble Fill the jar a third full with a 10 per cent solution of sulphuric or nitric acid place the wood cover on firmly lower the glass tube through the hole till it is ¼ inch from the bottom of the jar and tighten the spring against it Then put the rod through the glass tube till it is resting on the bottom of the jar In use when the circuit through the apparatus is closed non-conducting bubbles form and break on the anode thus interrupting the current If the interrupter is used on alternating current the anode will wear down quickly Connections using alternating current are identically the same as direct but without regard to polarity as alternating current constantly reverses poles If intended for continuous work the electrolyte should be cooled by running water through a coiled glass tube in the bottom of the jar This interrupter will successfully operate coils from the small sizes up to the 10 inch size and is especially desirable in wireless telegraphic transmission as it aids materially in the production of a penetrating high frequency wave

DEVICE FOR TESTING ELECTRIC WIRING

BY H WARD NICHOLS

In testing electric wiring for open circuits grounds or short circuits it is often necessary to skin the insulation from the wires under test in a number of places so as to connect them to a magneto or other testing device The accompanying illustration shows



TESTING NEEDLE FOR INSULATED WIRE

a device which does away with this necessity for it contains a sharp needle point which can be easily pushed through the insulation until it makes a good electrical contact with the wire within The device is made out of a hard wood handle bored throughout its whole length to the diameter of flexible lamp cord The small end is then counterbored to a larger diameter and a plug is made that will drive tightly into the counterbore The next step is to procure a large sized sewing needle which is driven through the plug as shown in the sketch The eye end of the needle is soldered to a length of lamp cord which is passed

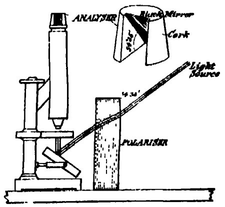
through the handle as shown The plug is then driven into place and the testing handle is ready for use

POLARISCOPE ATTACHMENT FOR MICROSCOPES.

Illustrated herewith is a bit of apparatus by means of which polarized light may be used with any microscope without changing the instrument itself The polarizer consists of one dozen 4 x 5 inch glass negatives which have been thoroughly cleaned and dusted, and are contained in the original box, which has its top and bottom cut out, leaving just enough card around the edges to hold the plates in position

The analyzer comprises a piece of blackened cork with a wedge-shaped slot cut in one side and a bit of black mirror firmly pressed into position in the slot at the polarizing angle This rests on the eyepiece of the microscope and may be turned at any angle in the horizontal plane The black mirror is made of plate glass or cover glass, coated on the back with a mixture of lampblack and shellac varnish or, if more convenient, lampblack and glue The drawing shows the arrangement of the apparatus with the Nicols' crossed A small scale may be attached to the top of the analyzer, so that the angle through which it is turned may be noted

This scheme may also be applied to a simple, or dissecting, microscope For simplicity and cheapness, combined with a high degree of efficiency, I do not



MICROSCOPE ARRANGED AS POLARISCOPE.

think this apparatus can be excelled The pleasure to be derived from its use is infinite

AN ELECTROPLATING OUTFIT
WITH PRACTICAL WORKING FORMULÆ
BY A. J. JARMAN

Those who wish to undertake the electro-deposition of metals upon a small scale whether as a *business* or for pleasure will find that *the apparatus* and utensils *here described* will meet the ordinary requirements

The photograph reproduced herewith shows the wooden depositing tank and battery of an outfit in actual use The battery cells are made exactly as explained on page 445 of the SCIENTIFIC AMERICAN of May 28th 1910

The depositing tank is made in the same way, with the exception that the joints are put together with a very thick India rubber cement of the kind used for repairing tires The woodwork at the joints is first coated with the cement, both at the grooves and the ends, and is allowed to stand for an hour or two, when it is coated again and put together either with nails driven in diagonally or with screws The excess of rubber must be wiped off In the course of about twenty four hours the inside of the tank must be coated with a burning hot solution of paraffin Unless the paraffin is very hot, it will not penetrate the pores of the wood sufficiently to make it impervious to any of the chemical solutions that the tank may contain The wood used in making a depositing tank must be well seasoned If possible use old boards one inch thick so that when planed the board is not less than seven-eighths of an inch thick, and at all times place cleats across the bottom, so that it will stand clear of the floor or work bench The rubber cement used for the joints will not be affected by any of the depositing solutions The tank illustrated measures 5½ inches wide, 12½ inches long, and 11 inches deep Five such tanks as these should be made, to contain the following cold working solutions, for silver, nickel, brass copper and zinc Gold and alkaline coppering solutions must be worked hot, as will presently be described

Silver Plating—Dissolve 2½ ounces silver in a glass flask by adding 3 ounces nitric acid and 1 ounce distilled water Heat the flask slightly and place it where the red nitrous fumes will pass off into a flue, or out of doors. When the silver has become dissolved, add a quart of distilled water, stir the mixture well, then add gradually about 5 fluid ounces pure hydrochloric acid, stirring the mixture well with a glass rod. Place the flask in a dark place while the white precipitate (chloride of silver) is settling. Pour off the clear liquid, add another quart of water; stir well, allow it to settle, decant; and wash a third time. This will free the precipitate of impurities formed. Dissolve ½ pound cyanide of potassium in ½ gallon of distilled water When completely dissolved, add a small quantity at a time to the chloride of silver Stir this well, and continue to add the cyanide solution until the chloride of silver has only just been dissolved. Allow a little time to elapse between each addition. When all the chloride of silver is dissolved make up the quantity to 2½ gallons with distilled water This will be the right quantity to fill the wooden tank, with one ounce of silver to the gallon Let this solution stand for twenty four hours, so that all dirt will settle, and then pour the clean solution into the tank. The solution is now ready for use.

Two sheets of fine silver about 5 inches square must be used for the anodes, suspended by either copper or silver wire hooks upon the copper rod (shown in the illustration) attached to the wire from the carbon of the battery, while from the bent copper rod the articles to be plated must be suspended, this rod being attached to the zincs of the battery The articles to be plated must be cleaned by boiling them in a strong solution of common washing soda for twenty minutes, rinsing in water, and scouring them individually with a stiff nail brush dipped in pumice powder or brick dust. Articles of German silver, brass, or copper, after scouring and being attached to the slinging wire, must be dipped into a solution of one ounce of nitrate of mercury in a gallon of water This will give a chemically clean surface and cause the silver to adhere firmly when the deposit takes place in the silver bath. Three or four spoons or forks should be submerged in the plating liquid quickly, before the anode of silver is inserted. [illegible] the conducting [illegible] with as [illegible] as it will [illegible] both anodes. [illegible] 16 [illegible] articles [illegible]

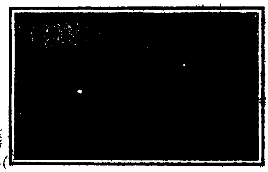
[illegible]

Only [illegible] cally cle[illegible] place it [illegible] at once. [illegible] color of [illegible]

Copper Plating—Articles [illegible] being nickel plated must be coated with a deposit of copper in the alkaline coppering bath, which can be used either cold or hot. If used hot, an enameled iron boiler will answer the purpose, but the heat must not exceed 130 degrees Fahrenheit for a bath of the formula given Dissolve ¼ pound sulphate of copper in ½ gallon hot water Also ½ pound carbonate of potash in 1 quart of water, and about 10 ounces cyanide of potassium in 1 quart water Add the carbonate of potash solution to the sulphate of copper Stir the mixture well Add enough strong liquid ammonia to dissolve the precipitate Then add gradually the cyanide solution until the blue color disappears. Make up to 2 gallons with distilled water, and after allowing the sediment to subside, pour off the clear liquid into the depositing tank. Have two anodes six inches square using the second anode according to the number of articles to be plated The two battery cells above referred to will perform all the work of deposition that this article describes. The cleaning of small iron or steel articles should be done just as described above for silvering. When the articles are coppered they must be scratch-brushed before receiving a deposit of nickel, silver, or gold; then scoured with fine pumice and water. They will then take a fine deposit of these metals.

Gold Plating—Electro-gilding in a small way is best done by making the gold solution as follows Dissolve in 1 quart of hot distilled water 1 ounce of cyanide of potassium. Take a small porous pot and fill it about two-thirds full Place it in the inner vessel of an oatmeal kettle, and pour in this vessel the balance of cyanide solution. Pour a quart of hot water into the outer vessel, and bring it to the boiling point. Take a strip of sheet copper, fix a piece of copper wire to it, and insert [illegible] the porous pot. Attach the wire to the [illegible] of the zinc of the battery, and a piece of sheet gold to the wire coming from the carbon of the second cell of the battery. Note the weight of the gold. Place the sheet gold in the liquid that surrounds the porous pot, and allow the action of the two cells to continue until 1½ pennyweight has been dissolved from the sheet gold. Remove the porous pot; throw away its contents, use the remaining liquid for the gold depositing, and the piece of sheet gold can be used for the anode. Any article after being well cleaned can be coated with gold in this bath, giving a very rich color. Stale beer is the best liquid to use with a scratch brush in brightening the deposit previous to burnishing. The brass wire brush used should be finer for gold than for silver The articles after rinsing should be dried in hot boxwood sawdust.

Zinc Plating—Articles can readily be coated with zinc by using the following solutions (Watts's process) 2½ gallons water, 1 pound cyanide of potassium, 10 ounces of 0.880 ammonia. Place this in one of the tanks. Fill two large porous pots with a plain cyanide solution, consisting of 4 ounces of potassium cyanide to 1 quart water. Place a strip of sheet copper the width of the porous pot in each, and connect the copper with the battery as for gold, using two large clean zinc plates in the ammonia cyanide solution until about 6 ounces of zinc have been dissolved. Remove the porous cells and throw the contents away.



COMPLETE OUTFIT FOR ELECTROPLATING.

Add 5 ounces carbonate of potash, stir until dissolved, let the liquid stand until the dirty matter has subsided, and then siphon off the clear liquid, which is now ready for use. [illegible] the articles as for silver, using sheet zinc for the anode A very fine deposit can be obtained by this solution The articles should be removed occasionally to see that the deposit is going on satisfactorily If not, scour them slightly with pumice and water, rinse, and return to the bath. When the deposit is complete, the articles may be left dead in color or scratch brushed.

Brass Plating—Electro-brassing can be done by the following solution, bearing in mind that metals of the same kind only must be attempted. Wrought iron, cast iron, or steel must be plated separately Make up the following solution 4 ounces cyanide of potassium dissolved in half a gallon of warm water, 1½ pounds carbonate of potash dissolved in ½ gallon water, 2½ ounces acetate of copper dissolved in 1 quart water, 5 ounces sulphate of zinc dissolved in ½ gallon hot water Let all the solutions be cold before mixing Add to the acetate of copper solution ½ pint strong water ammonia, 0.880 Just before final mixing, stir this well and add to it the zinc solution, together with another ½ pint strong ammonia. Stir this mixture well, then add the potash solution, and lastly the cyanide solution. Allow this to stand after making the quantity up to four gallons. At the end of about 12 hours pour the clear liquid into the depositing tank, for use. Clean the articles as for silver plating, use the battery coupled in multiple, and a large brass anode, arranged so as to regulate the quantity of surface in the liquid. The exact color can be obtained by raising and lowering the anode. After a quarter of an hour the articles must be removed, rinsed, scratch-brushed, and returned to the bath for the final deposit. In every case in the electro depositing of metals, especially in the gold and brassing, the color can be varied by moving the article to and fro in the solution during deposition. Silver is also affected by this means, the deposit being much whiter when the article is moved.

Pewter, lead, or zinc articles must be electro-coppered previous to silvering or gilding, as well as wrought iron and steel. Special solutions must be made for plating these articles upon a large scale without coppering.

A liquid japan for leather is made as follows: Take four pounds of molasses, half a pound of lampblack, half a pound of sweet oil, and an equal quantity of gum arabic, also half a pint of isinglass. Mix well in 14 pounds of water; apply heat, and when cool add one pint of alcohol.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT-FORM.—S. T. Palmenburg, New York, N. Y. This form is such as is used in stores, show windows, dressmakers' establishments and the like. The aim of the invention is to provide improvements in garment forms, whereby the body of the form can be readily adjusted to assume a desired pose and thus display the garment to the fullest advantage.

HAIR-COMB.—J. H. Ahrn, East Orange, N. J. The invention relates especially to combs of the type used for dressing the hair, the particular improvement being to provide the comb teeth with channels for the purpose of receiving the dandruff dust, and various other impurities gleaned from the head by the action of the comb.

Of Interest to Farmers.

MEASURE.—R C Harbridge, Margo, Saskatchewan, Canada. The invention is an improvement in dry or liquid measures, which are constructed of one or more sections adjustably received one within the other, whereby the capacity of the measure may be varied. As many farmers do not possess scales, the measure is particularly adapted to their use.

Of General Interest.

REIN-HOLDER.—K Tharaldson, Bloomingdale, Cal. This holder is for convenient attachment to the hip pad of the harness, and is arranged to hold the reins in position along the back of the animal, to allow free lengthwise movement of the reins, to provide sidewise movement thereof and to permit placing the reins conveniently and quickly in position in the holder or removing the reins therefrom.

KILN.—W Drayton, Kachelmacher, Ohio In this patent the invention has reference to certain improvements in kilns adapted for burning brick or other ceramics, and involves a system whereby a plurality of separate portable kilns are arranged in series to form a continuously moving tunnel in which the bricks are first dried, then burned, and finally cooled.

GUIDE-RACK FOR FIRE-HOSE.—E. B Willis, New York, N Y This inventor provides for directing from the ground the stream from a fire hose, a supporting structure upon buildings to guide the nozzle end of a hose pipe when shifted along a building, a permanent hose supporting carriage and operating track therefor disposed in line with the tiers of windows and for shifting the same from window to window, the means provided being operable from the ground.

PIPE.—W H Stokes New York, N Y The purpose here is to provide a simple pipe for smoking tobacco, which renders the use of tobacco more healthful, in which the tobacco smoke is cooled before entering the mouthpiece, so that it is rendered more palatable, and in which impurities are removed from the smoke.

MEDICINAL PREPARATION.—C Heinsinger, New York N Y The object of this improvement is the provision of a simple and inexpensive lotion for use in various diseases of the eye, which has a pleasant and stimulating action with regard to the tissues, and which is particularly useful for the treatment of trachoma and like diseases.

AIR-COMPRESSOR.—D R Allard, Arleta, Ore The main object in the present invention is the provision of means by which the force of the waves of the sea or other body of water may be used to best advantage for compressing air The same action will take place from the rise and fall of the tide as well as from the force of waves and hence the invention contemplates a tide power device as well as a wave power device

SAFE.—R. S. Elliott, Laona., and G Cook, Gillett, Wis. In this case the invention is an improvement in safes, and the purpose is the provision of a safe especially adapted to resist the insertion of explosives thereinto, and to prevent the insertion of a sufficient amount to cause any damage by exploding the said explosive in detail and in small amounts.

TOY BALE.—A. Hirschwitz and H Maudheim, New Orleans, La This bale can be made in any miniature size and will present the appearance of a cotton bale and thus be desirable in certain sections, especially the cotton growing sections, and will afford in connection with a simple hollow body portion, corrugated to heighten the resemblance to a cotton bale or other complete bale, means for receiving a drawer which can be utilized as a receptacle for confectionery or other suitable merchandise.

PROCESS FOR CONVERTING GLUE.—C. M. Strebelman, Cincinnati, Ohio. This invention refers to a process for converting or melting glue, and its object is to melt the glue in a very short period of time, thus avoiding the long continued application of dry heat at high temperature, which destroys the fibrous matter of the glue and diminishes its strength.

Hardware and Tools.

NUT-LOCK.—J. C. Austin, New York, N Y In this instance the invention has reference to nut-locks for use with ordinary or special bolt nuts and the like, and it relates more particularly to a device of this class having a resiliently expansible body and provided with a threaded bore of varying diameter

LOCK.—M. H. Farnum, Virden, Ill. One object of the invention is to provide a simple form of locking mechanism which may act in the manner of an ordinary spring lock until the door or other swinging member to which it is applied is shut, when the lock will immediately become "dead" and will require a key to unlock it.

COMBINED MATCH BOX HOLDER AND CIGAR-CUTTER.—E. Oldenbusch, New York, N Y The holder is adapted for receiving and protecting the common form of match-box, and it is the location, construction and arrangement of the cutter which embodies the main features of the invention The cutter is secured to the end of the holder and operates to limit the inward movement of the box and to permit the box to be automatically opened upon insertion of a cigar within the cutter The last does not interfere with the free opening of the box, and the top of the cigar removed by the cutter falls outside rather than inside the box.

Heating and Lighting.

THERMOSTAT.—W Entzelins, Big Run, Pa In the present patent the invention has reference to thermostats, and it has for its object the provision of one for use in regulating the flow of gas used to heat water in boilers, which is certain in its operation and one which may be manufactured and repaired at little expense.

HEADLIGHT BURNER.—C E Powers, Baltimore, Md The invention relates to headlight burners of the kind adapted to consume oil, the more particular purpose being to provide intermediate the lamp wick and the oil reservoir a member of peculiar shape and offering especial advantages relative to the flow of the oil from the reservoir to the wick.

INVERTED GAS BURNER.—E. Steil, No 14 an der Apostelkirche, Berlin Germany The object is to so construct the burner that by the removal of the mixing tube of the Bunsen burner, which is detachable in the usual manner the gas nozzle is simultaneously moved into such a position that it is readily accessible, which presents the advantage that the clearing of the discharge aperture, which is frequently necessary, can be effected speedily conv[illegible] of widening [illegible]

MOP WRI[illegible] Minn The [illegible] provide det[illegible] adapt the [illegible] edge portion [illegible] liable support for [illegible] adjacent to [illegible] the side of [illegible] enable the [illegible] fibrous mop [illegible] from the mo[illegible]

DISINFEC[illegible] Melville, N[illegible] vides a sect[illegible] ing tank to [illegible] to the disin[illegible] other, to direc[illegible] ing from the [illegible] last having [illegible] lower opening [illegible] in the bottom [illegible] communicating [illegible] ing on the latte[illegible] ported on arm[illegible] close proximity [illegible] ing chamber

Machines and Mechanical Devices.

FLUID EXPANSION PRESS.—L. C Turley, Portsmouth, Ohio. The objects here are, 1 To shift the die cap into and out of position relatively to the die, by turning an expansive medium on and off for actuating the moving elements so that a single application is sufficient to cover the die and to squeeze within the same the article to be pressed, and that the release of the medium from the press not only restores the die to normal condition, but also removes its cap. 2 To enable the release of the medium to remove the cap by a plurality of motions, first raising the cap clear of the die and then shifting the cap in a lateral direction, the cap performing these movements universely whenever the medium is turned on

SEPARATOR.—M L. Jones, Baltimore, Md In this case the invention has reference to separators for centrally separating materials having a different specific gravity, and partake of rotatable means for separating a material having a lighter specific gravity from a material having a heavier specific gravity, and vice versa

AUTOMATIC GUN.—G Colleoni, New York, N Y. The main objects here are to provide for maintaining the barrel at a comparatively low temperature, for regulating the quantity and pressure of the gas delivered to the piston; for more effectively transferring cartridges from the feed strip to the breech piece; for bracing the breech block against return movement at the instant of explosion, and for operating the firing pins.

TYPE-WRITER ATTACHMENT.—J L. Murphy, Covington, Va. The object here is to provide an attachment which may be easily attached to and detached from a typewriter carriage, and which will support a plurality of superposed strips of paper, and pass them through the typewriter, and which will automatically separate the fair copy from the carbon and deliver it from the front of the machine, and will roll up the copy and retain it in such condition until removed.

CLUTCH MECHANISM.—F E Sudduth and W T S. Weaver, Omaha, Neb. The object of the improvement is to provide a mechanism especially adapted for automobiles, but equally advantageous for other machinery requiring a variable speed, whereby the relation of the speed of the driven means to the driving means may be varied within the widest possible limits.

Railways and Their Accessories.

METALLIC RAILROAD-TIE.—A S Warren, Batavia, N Y The improvement provides a tie having details of construction that prevent it from creeping endwise, or sinking into the roadbed, a further object is to provide effective means for securing track rails upon the improved cross ties that may be readily released for track repairs and quickly resecured as occasion may require

SAFETY GATE FOR RAILWAY CARS.—F T Fillion North Platte Neb The gate is so constructed that it is held suspended or folded vertically out of the way, when cars are coupled, but is automatically released, and falls into position across the end of the car platform when the train is broken, that is to say, when the car to which the gate is attached is parted or uncoupled from the next one

Pertaining to Recreation.

TENNIS-COURT MARKER.—E A Robinson, Emporia Kan This improvement is in devices for marking the lines of tennis courts and other purposes and the object is to produce an implement which may be used for marking off on the ground the necessary lines, boundaries, etc of tennis and other courts and one which can be readily filled with the marking material and which can be used on even surfaces.

Pertaining to Vehicles.

VEHICLE TOP.—H C Martell, Flint, Mich. This improvement is in a vehicle top and when the top is extended it forms an [illegible] covering for the vehicle, and without [illegible] into and to de[illegible] front bow is [illegible] folded, it is [illegible] of space [illegible] patents will [illegible] cents each [illegible] patentee title of [illegible] paper

[illegible]ueries.

[illegible] sheets when writing [illegible] patents, subscriptions, [illegible] your queries [illegible] and address on every [illegible] printed at the head [illegible] June 18th, 1910, or will [illegible]

[illegible] That introduc[illegible] reduces the num[illegible] of course plain ac[illegible] the amperes being equal [illegible] divided by the resist[illegible] also always been under[illegible] resistance introduced into a circuit reduced also the effective voltage of the circuit after the current had passed through the said resistance and that the voltage would fall according as more or less resistance was introduced. The following experiment is therefore hard to explain if this is so We connected two 110 volt lamps in series on a 220-volt circuit and in the opened point as shown below after the current had first passed through the lamps inserted a large standard voltmeter which read 218 to 220 volts. This was repeated many times with the greatest precautions as to connections and also on other sources of supply and the results were the same in a general way apparently no drop of any appreciable extent having occurred by the passage of the current through the lamps although of course the amperes were cut down What is the explanation of this? Much discussion has arisen over it, and the claim made that the voltage should have been reduced

A The case of the lamps and the voltmeter as you describe it is no exception to Ohm's law The resistance was not that of two lamps in series, but of two lamps and a voltmeter which had a resistance of many thousand ohms. The current in amperes became inconsiderable because the resistance was so high, and the voltmeter registered only the voltage The voltage would be the same as if the lamps had not been in series in the line No amperes were flowing, or at most a very small fraction of one ampere The point is this the voltage at the end of an open circuit is the same as that any where along the circuit The *drop between any two points of a closed circuit* is proportional to the resistance between those two points. If the circuit which you show in your figure had been closed the lamps would have lighted, showing that current was flowing, and the voltmeter would then have shown 110 volts drop between the two terminals of each lamp. This is in strict accordance with Ohm's law.

NEW BOOKS, ETC.

The Manual of Statistics Stock Exchange Handbook for 1910 New York The Manual of Statistics Company, 1910 12mo, 1086 pp Price, $5

This volume, which is the thirty second annual issue deals with railroad securities industrial securities, government securities stock exchange quotations, mining grain and provisions, cotton, money and information relative to bank and trust companies. It is accompanied by a number of well-executed maps and reference is made easy by the aid of thumb indexes. The book is a model compilation Rarely have statistics been presented in clearer form It is an indispensable handbook for the desk for all who are in any way interested in financial matters. There is hardly a person who does not have occasion at one time or another to refer to matters dealing more or less with the statistics of finance

Danbury Rodd Aviator By Frederick Palmer New York Charles Scribners Sons, 1910 12mo, 310 pp Price, $1 50

The average work of fiction devoted to any new science or sport is apt to be rather foolish, and in this respect Danbury Rodd is different from many of its predecessors. There is little question that the aeroplane has come to stay like the automobile although its field of usefulness is rather more restricted By far the best story of the eleven is entitled 'A Cure by Aeroplane' in which a railway magnate is kidnapped, taken to his own island in the St Lawrence River for a rest cure of a month The book fairly reeks with gasoline planes propellers, trimming planes and all of the aeroplanist's patter It is a very readable book and is certain to have an excellent sale The book was brought out at a psychological moment

Altitude Tables Computed for Intervals of Four Minutes Between the Parallels of Latitude 24 Deg and 60 Deg and Parallels of Declination 24 Deg and 60 Deg Designed for the Determination of the Position Line at All Hour Angles Without Logarithmic Computation By Frederick Ball, M A London J D Potter, 1909 8vo, 43 pp

The New Baedeker Casual Notes of an Irresponsible Traveler By Harry Thurston Peck, Ph D New York Dodd, Mead & Co, 1910 12mo, 352 pp Price, $1 50 net

Now that the 'Scientific American Hand Book of Travel' is being purchased so largely by travelers who are thinking of making the voyage we feel that our readers will be more than interested in knowing of any new books on the subject If you have ever been to Berlin Utica Atlantic City Brussels Winnipeg or any of the places written about by the Irresponsible Traveler If you ever intend to visit them or feel any interest in them whatsoever get a copy of 'The New Baedeker' Almost as good as a visit to a place is the Irresponsible Traveler's light humorous and yet wonderfully keen and adequate description of it He tells about a little out of the way bygone summer resort called Trenton Falls in a way that makes you vow you will go there He formulates on paper the essence of Atlantic City And there are chapters on Liverpool and on Havre which no transatlantic traveler irresponsible or otherwise should fail to read

American School Gardens By M Louise Greene, M Pd Ph D New York Charities Publication Committee, 1910 12 mo 388 pp Price, $1.25

This is a publication of the Russell Sage Foundation and is a splendid example of how well the money of the late financier is being expended for the benefit of humanity There is nothing which appeals to the imagination more than school gardens and the writer has taken special pains to visit some of these gardens The book itself is handsomely gotten up and is admirably adapted to awaken a great interest in farming' school gardens There has been need of a manual as it were on this important subject and the author seems to have succeeded in producing a very thorough and scientific work The bibliography alone is an imposing piece of work while the list of various seeds etc which should be planted shows remarkable knowledge of the subject The book is unquestionably based on personal observation and is beautifully illustrated with one hundred full-page and small half tones When publications of this kind are seen it makes one wish that more millionaires would leave their money with as much discretion as to the means by which it should be expended as did Mr Sage

Work Accidents and the Law By Crystal Eastman. New York Charities Publication Committee, 1910 8vo, 345 pp Price, $1 50

This is a part of the Pittsburg Survey The findings will be published in six volumes. A splendid work of this nature would be impossible were it not for the Russell Sage Foundation A wiser expenditure of money could hardly have been devised The study of industrial accidents and their betterment has attracted the attention of the foremost mechanical thinkers and industrial engineers The editors of the principal technical papers in New

York are banded together to help support the American Museum of Safety This journal itself is vitally interested in the question of safety for industrial workers, safety on the railroads, and safety at sea The terrible loss of life and limb which is exacted each year as the industrial toll is something enormous. Each year 700,000 people in the United States, men, women and children, are either killed or maimed by accidents which in most cases are absolutely preventable There are, of course, certain accidents which may occur in heavy machinery which are the result of defects which cannot make themselves manifest during the progress of manufacture, but in the majority of cases it is possible to either prevent this industrial loss or to at least minimize it so that the damage is not so great. The book before us is one of the finest expounents we have ever seen of this twentieth century humanitarian interest The illustrations are clear cut and to the point and are beautifully executed The illustrations show what a cruel and deceptive looking place is a freight yard at night, with its ghastly white, green and red lights seemingly inextricably confused There are illustrations of the dangers which surround the workers in great metallurgical plants, also the great need of guards for the protection of wood working machinery The suggestions for prevention are many and are absolutely sound. The United States Steel Corporation has already expended large sums to safeguard their employees, and not from any selfish motive which is the best thing about the whole situation Plants all over the country are expending large sums to insure the safety of their employees, not with the idea that they will lessen the damage suits but from an earnest and honest desire to prevent the shocking industrial waste It is a small thing to put on the pay envelope "You are responsible for the safety of others as well as the safety of yourself" but a little sermonette of this kind often bears fruit The book has one of the best indexes we have ever seen, and the whole book is a great credit to everyone concerned

THE UNMASKING OF ROBERT-HOUDIN Together With a Treatise on Handcuff Secrets By Harry Houdini London George Routledge & Sons, Ltd, 1909 12mo.

The author of this book is a well known performer on the vaudeville stage Unlike most men of his calling he takes a commendable historic and academic interest in it. We venture to say that he probably stands unique in that respect To perform the enormous amount of research which he has evidently conducted requires not only a love for the art of prestidigitation and magic but also expert knowledge Both of these Mr Houdini possesses to a marked degree After reading his book there can be no doubt that Robert Houdin brought very little to the art of conjuring that, like many conjurers, he was a more or less slavish imitator of those who went before him Although he makes no pretensions to literary excellence Mr Houdini has written a most fascinating book on a fascinating subject His historical researches he has supplemented with comments on his own performances which reveal how many of the handcuff tricks which astonish vaudeville spectators of to-day are performed

OBERAMMERGAU By Josephine Helena Short. New York Thomas Y Crowell & Co, 1910 16mo, 184 pp Price, $1 net.

The object of this book is to give an intimate description of the village where the Passion Play is produced, of the people of the village and their everyday life with special attention to the characters chosen to take part in the sacred drama. The author has visited the locality at times when it was not thronged with tourists, and has established herself on terms of friendliness with the inhabitants A helpful résumé of the Passion Play is included in the volume, together with other information of value to visitors to Oberammergau and of interest to those who travel only through the medium of books The writer of this review has also had the great pleasure of seeing the Passion Play and he can certify to the completeness of the descriptions of both the place and the great religious drama that is enacted therein

THE WORLD'S BEST BOOKS. Suggestions for the Selection for a Home Library Cincinnati The Globe-Wernicke Company, 1909

The book before us, which consists of some 37 pages luxuriously printed on beautiful paper, contains a carefully classified list of books desirable for the home library arranged appropriately Thus we find the one hundred best books of Sir John Lovatt Canon Farrar's list of twelve his list of five lists of best books for boys and girls the ten best novels twenty best novels novels of the West novels which picture English life novels of the sea problem novels, and lastly Dr Eliot's five-foot library and Roosevelt's pigskin library There is certainly very valuable information condensed in a short space By the by, the book is sent free of expense.

CAMP COOKING. By Horace Kephart. New York Outing Publishing Company, 1910 16mo., 154 pp. Price, $1

At last we have a good book on camp cookery. The ordinary cook book would be very useless in a camp, as many of the ingredients could not readily be obtained. The book before us is one of the best cook books that have ever come to this reviewer's table. It gives precisely the information that is required, and in a scientific manner which is greatly to be commended The recipes are thoroughly common-sense, and include directions for cooking all kinds of dishes which smack of the woods, as deer's brain, moose muffle, venison sausages, jambolaya, "possum," fish baked in clay, and many other equally valuable dishes. Such ordinary articles of food as corn bread are also described The book is small and will readily slip in the pocket. It will not add a great deal to the weight. The slip cover is very handsome, and the photograph is worthy of better use.

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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863 will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

MANGANESE STEEL RAILS.

(*Concluded from page 516*)

rails used by the Boston Elevated upon its curves were formed by casting. This is, of course, an expensive process In fact, this corporation rail costs about $5 per foot for the rails. The ordinary rail costs only about 38 cents per foot, or only 1/3 as much. But even then it is regarded as a good investment, because of the very long life. In the autumn of 1908 the company had in service 475 feet of this rail in addition to three crossing frogs and a number of ordinary frogs. Its experience is certainly worthy of attention However, if manganese steel can be rolled to advantage, we may expect a still better material at a lower figure. In fact, such rails have been rolled to sell for about $200 per ton, or about $2.50 per foot (about 85 pound section).

Perhaps a considerable portion of the expense of rolling manganese-steel rails is due to the considerable piping to which ingots of this material are subject, requiring thus a large discard or special means of prevention On the other hand, considerable blow holes are thought to be infrequent, if they occur at all This is attributed to the high percentage of substances which have a stronger affinity for oxygen than iron This will be better understood, perhaps, by considering an analysis of manganese steel

	From	To
Manganese	0 1100	0 1300
Carbon	0 0100	0 0120
Silicon	0 0025	0 0040
Phosphorus	0 0006	0 0011
Sulphur	0 0002	0 0006
Iron	0 8767	0 8523
	1 0000	1 0000

Some of the difficulties of rolling this metal have been given by Mr W S Potter When the temperature has fallen as low as about 1,300 deg F, it becomes apparently inadvisable to continue, not merely because of the great difficulty of making reductions, but more especially because, when air-cooled afterward, the metal will be found to have a coarse structure and to be wanting in some of its desirable qualities The steel may, however, be restored by reheating and quenching. However, we have then lost that excellence which results from rolling. Consequently, for the usual methods, 1,300 deg. F is to be regarded as the lower limit. As to the upper limit—it is necessary to avoid burning or cracking for the reason that then the steel will be apt to crush in the mill Apparently, the upper limit beyond which it is scarcely safe to go is about 1,875 deg. F We have then a thermal range of about 575 deg F in which to effect the rolling. But a rail ingot in the ordinary American practice has lost about 900 deg F by the time it has passed through the finishing rolls. Now it may be that manganese steel may cool somewhat more slowly than the ordinary rail steel But we cannot expect the difference between 575 deg and 900 deg to be thus made up So that, if we should proceed by the usual methods, we would be unable to secure our desired result. However, manganese steel has been successfully rolled in France, in England, and in the United States.

HAMILTON'S AEROPLANE FLIGHT

(*Continued from page 521*)

by Curtiss in his trip down the Hudson—he quickly rose into the air and made a large circle over the island. When he left the shore and started to cross the Lower Bay four or five minutes had elapsed, so that the actual start was made at about 7 40 After flying across the bay and the Kill von Kull, Hamilton struck the line of the Pennsylvania Railroad at South Elizabeth, and followed it practically all the way to Philadelphia The special train, bearing a white streamer on the roof of the foremost car, soon located him and caught up with

(*Continued on page 538.*)

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Inquiry No. 9038.—Wanted the address of the Chipman Electric Purifying Co.

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Inquiry No. 9050. Wanted to buy machinery to manufacture dried corn racks.

FOR SALE. Patent No. 960,294, as per notice in this issue of SCIENTIFIC AMERICAN. J. H. Melville, 69 Broadway, New York City.

Inquiry No. 9075. Wanted to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

FOR SALE. Patent No. 965,201. A machine on which one man does the work of a hundred (100). For further information address F. Rogowski, 2120 Frankfort Street, Chicago, Ill.

Inquiry No. 9076.—Wanted the address of parties in Canada who could make a safety razor.

LISTS OF MANUFACTURERS

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

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Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

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Inquiry No. 9083. Wanted, the address of firms manufacturing small beer brewing plants from 15 to 100 gallons a day.

MISCELLANEOUS.

WE are about to complete a large contract for Taximeters and are therefore in a position to take up experimental work, manufacture of fine instruments, parts for the same, dies, jigs, etc. Precision Tool & Instrument Co., 9-15 Canal Place, New York City.

Inquiry No. 9091.—Wanted address of The Thomas Arithmometer Company; also Burkhart Arithmometer Company.

Inquiry No. 9096.—Wanted, the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097. Wanted address of makers of impulse water wheels.

Inquiry No. 9099.—Wanted address of manufacturers of machinery for making wire cables.

Inquiry No. 9107.—Wanted addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109. Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9113. Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114. Wanted a machine for making peg tubs, similar to Wm. Mitchell's 6 & 7 tubs and Waverly pins.

SQUEAKS

stopped; "3-in-One" oils everything right, locks, clocks, hinges, sewing machines, typewriters; generous free sample sent by 3 IN 1 OIL CO. 14 Broadway, New York.

Inquiry No. 9118. Wanted, a muffler for a gasoline engine built upon the principle of the Maxim silencer recently brought out for use on rifles.

Inquiry No. 9120.—Wanted, the address of the Ideal Fuel Feeder Co.

Inquiry No. 9121.—Wanted manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9124.—Wanted name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9134.—Wanted, a small hydraulic motor, capable of giving about one horse power with a water power of 25 lbs. per square inch.

Inquiry No. 9135.—Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted, the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted the address of manufacturers of machines capable of forming a number (12 or more) of pieces of paste about 35 mm. x 25 mm. x 4 mm., made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 4 mm. The process would be somewhat similar to biscuit making.

Inquiry No. 9139.—Wanted the name and address of some manufacturer of a coffee mill run by water motor.

Inquiry No. 9140.—Wanted, manufacturers of disc records for gramophones that use a sapphire point instead of a steel needle.

Inquiry No. 9143.—Wanted name and address of the manufacturers of an air mattress.

Inquiry No. 9144.—Wanted, manufacturers of machinery for making soda water tubes, commonly known as straws.

Inquiry No. 9145. Wanted to buy machinery to load blasting caps or detonators.

Inquiry No. 9149. Wanted, manufacturers of machinery for roasting coffee for small and large industries.

Inquiry No. 9150. Wanted, manufacturers of machinery for the manufacture of French heels for ladies' shoes.

Inquiry No. 9152. Wanted, the address of the Graham Safety Lamp Filler and Ventilator.

Inquiry No. 9153.—Wanted, name and address of manufacturers of a knotless clothes line.

Inquiry No. 9155. Wanted, the address of manufacturers of an electric milking machine.

Inquiry No. 9157.—Wanted, manu[illegible] peanut shelling and [illegible]

Inquiry No. 91[illegible] grind oranges, pulp [illegible] cream.

Inquiry No. [illegible] makers in Manh[illegible] special design.

Inquiry No. 91[illegible] cradle worked by [illegible]

Inquiry No. 91[illegible] vacuum pump th[illegible] inches of air per [illegible]

Inquiry No. 91[illegible] Schurmann Street [illegible] ing Co.

Inquiry No. 91[illegible] German Quartz Co.

Inquiry No. 91[illegible] facturer making th[illegible] sometimes called [illegible]

Inquiry No. 91[illegible] manufacturers of [illegible]

Inquiry No. 917[illegible] movable apparatus [illegible]

Inquiry No. 91[illegible] mail order house.

Inquiry No. 91[illegible] Arnold Vacuum [illegible]

(Continued [illegible]

him, and for ten or [illegible] directly over the tra[illegible] behind so that the [illegible] catch him Shortly [illegible] delphia was reached he [illegible] the train and, before alighting, he made two large circles above the field that was his destination.

The greater part of the trip Hamilton flew at a comparatively slight elevation —about 200 feet. Even in passing over the city of Trenton he rose to only double this height, as he preferred to take the chance of his motor stopping and of his being obliged to descend rather than to cut down his average speed by rising to a great elevation.

The various cities and towns along the route were passed upon schedule time.

After reaching the field at North Philadelphia and circling about a couple of times Hamilton alighted gracefully at 9 26 A. M., just 1 hour and 50 minutes from the time he started. If a deduction is made for the circling about at the start and finish, the actual time of the flight was about 1 hour and 45 minutes. The airline distance is 74.7 miles from Governor's Island to North Philadelphia, but over the route followed by Hamilton it was 83.9. The average speed, therefore, with the time of the circlings deducted, was 47.37 miles an hour, or 45.88, using the full time. In other words, Hamilton had started from an inaccessible island in New York harbor and traveled to North Philadelphia in considerably less time than one could accomplish this journey by boat to Jersey City and rail to [illegible]

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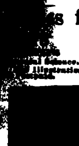

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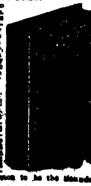

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to more destination with a special [illegible] boat and express train at command, the directness of air communication was forcibly demonstrated.

After being greeted by Governor Stewart and delivering to him the message, as shown in one of our illustrations, Hamilton refilled his fuel and oil tanks, and started on the return trip at 11:33 A. M. The special three-car train was delayed ten minutes in starting, and despite the fact that the train was driven at the fastest possible speed—80 miles an hour or more—its occupants did not catch sight of Hamilton until 23 minutes after they started, while it was about 10 minutes later before they finally overhauled him, 2 miles beyond Princeton Junction and 39 miles from the start. Thirty-seven miles had been covered by the special in 34 minutes, including a stop of 2 minutes at Bristol caused by an express train being in the way. The train and aeroplane traveled abreast of each other for a while, and finally Hamilton dropped slightly behind. He had covered the first 38 miles of his return journey at the rate of 51.8 miles an hour, thus making the fastest cross-country flight yet accomplished. At the small village of Plainsboro, 41 miles from North Philadelphia, Hamilton again flew over the tracks a thousand feet or more back of the train. The heavy clouds of smoke from the locomotive caused him to seek a higher elevation, and he rose to a height of about 800 feet. Soon after crossing the Raritan River the occupants of the train were surprised to see Hamilton turn off to the right and pass out of view. It seems he mistook the river for the Kill von Kull, and started, of course, toward what he supposed to be Governor's Island. The engine had been missing fire on several cylinders, and it finally was running on but six of its eight. Seeing what appeared to be a fine, smooth field below him, Hamilton decided to alight, but was quite dismayed to find himself in a marsh, from which the machine was dragged out with no little difficulty. In attempting to start, Hamilton again broke his propeller, and was obliged to send to Governor's Island for the only remaining one available. Several hours were consumed in getting this propeller—which, by the way, was the one that Curtiss used at Rheims in the Gordon Bennett race—but as soon as it arrived Hamilton immediately put it on and started once more, at 6 17 P. M. As the propeller was cracked and had been patched up with sheet tin, Hamilton feared it might break before he could complete his journey. He therefore rose to a considerable height—about 1,500 feet—and made a wide circle over Elizabeth. While above the city the engine again started missing and running on but six cylinders. Fortunately, however, his height was sufficient, so that he just succeeded in making Governor's Island during the course of his long descent. The 19¾ miles air-line distance from South Amboy to the Island was covered in about 23 minutes, and he finally alighted in front of the shed at 6 40 P. M.

In addition to this being probably the fastest cross-country flight ever executed, Hamilton's performance was a spectacular one, since the flight was made over water, cities, and open country. When news was received at New York that he had started on the return trip, thousands of people gathered at the Battery, expecting to see him arrive at Governor's Island at about 1 15 P. M. When word came that he had been forced to alight, the crowd was greatly disappointed. Nevertheless, there was a large crowd still when he finally crossed the Bay and alighted before sundown. The weather was humid and hazy, but the air was altogether calm. Hamilton was disappointed that he was unable to make the return trip without a stop. He would have been able to do this had it not been for motor troubles. As far as the aeroplane itself was concerned, this was well [illegible]

(Continued on page [illegible])

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The * Indicates that the Article is Illustrated with Engravings.

(Concluded from page 530.)

[illegible], but Hamilton suffered from [illegible] weather of the aviator, a mo[illegible] down. The motor does not seem to have been as thoroughly inspected as the rest of the machine, and the aviator has expressed the opinion that some missing piston rings in one or two of the cylinders allowed oil to escape by the piston and foul the spark plugs. There was no interruption in the sparking current supplied by the high-tension Bosch magneto. At any rate, Hamilton's flights showed the possibility of carrying mail and important dispatches, and it is interesting to note that Representative Shepherd of Texas has introduced a bill into Congress calling for the investigation of the Post Office Department into the aeroplane for the purpose of carrying mail. Also a few days after Hamilton's flight, the French war authorities commanded M. Blériot to carry a message from the camp of Chalons to Paris, which he did promptly in his monoplane without any mishap. During the present week Hamilton is to experiment for the government at Nashville, Tenn., upon the dropping of explosives from his machine. These experiments will be carried on during the maneuvers.

The flights of Curtiss and Hamilton have spurred many budding aviators to attempt in the near future some of the cross-country flights for prizes, and new prizes are being offered almost daily for such feats. We wish to remind such aviators that they stand a chance of winning the SCIENTIFIC AMERICAN Trophy if they send in their entry to us or to the Aero Club of America twenty-four hours in advance. The aviator making the longest cross-country flight this year will win the trophy for 1910.

Emery.

BY WALTER C. GOLD.

There are three qualities of emery used in this country—Naxos or Greek, Turkish, and American.

The Naxos brand is imported from the island of Naxos (Grecian Archipelago), Greece, the mines being controlled by the Grecian government. Naxos emery contains a large percentage of alumina (about 65 per cent). This emery has a most excellent fracture, the grains being very hard and very sharp, and therefore especially adapted for use in grinding wheels. These characteristics prevent its use, to any extent, for polishing purposes, as it neither "breaks down" nor granulates under pressure of the work, as do the other qualities (Turkish and American). An ideal emery for polishing must present new cutting points constantly. The Naxos grains are so hard and sharp that it does not properly granulate, therefore it is not a desirable polishing medium, except for certain special classes of work. Naxos emery, owing to its large percentage of alumina, follows corundum in the scale of hardness.

Good Turkish emery contains anywhere from 15 per cent to 25 per cent oxide of iron (the larger the percentage of oxide of iron, the softer is the emery) and it is used therefore exclusively as a polisher on "hard work." Turkish emery has a good fracture, and is just tough enough to make it ideal for polishing purposes.

American emery contains about 45 per cent oxide of iron, and is therefore the softest emery produced, yet is successfully and largely used for certain classes of "soft work."

Most of the Naxos and Turkish emery brought to this country comes in pieces ranging from the size of a marble up to 25 or 30 pounds in weight. Formerly it was brought over as ballast in ships, but it became such an important commodity commercially, that during the last quarter century it has been transported across the water as regular cargo. Turkish emery is brought to the seaports of Asia Minor in the same primitive fashion which has existed for many years—on the back of camels. There are no up-to-date mining methods. The ore is taken from the surface only, and no attempt is made to follow the emery "leads" when they dip below the surface. Thus their mining methods are thoroughly characteristic of the inhabitants of the entire Turkish empire—crude and antiquated. Emery imported from Asia Minor is branded according to the seaport from which it is shipped, the seaports being Smyrna, Kulluk and Syra, the railway points are Knyujack, Alden, and Azizick. The different brands of course vary according to the purity of the emery—the larger the amount of oxide of alumina, the better the quality.

The American emery is mined near Peekskill, New York State. Some very excellent ore has been taken out at that place, but the bulk of the emery is high in oxide of iron and therefore soft. There is also a small deposit in the State of Kansas, but the deposit is insignificant and the quality of the emery of an inferior character.

The following are the physical properties of emery: Color, black or blue black; specific gravity, 0.1050 ounce. It is thus placed in scale of hardness: Pure Naxos $8\frac{3}{4}$, pure Turkish $8\frac{1}{2}$, pure American $8\frac{1}{4}$ (the diamond being No. 10).

In its manufacture the emery passes through great chilled rolls and crushed. It then passes over screens made from bolting cloth, and from the screens it is packed directly into full kegs holding about 350 pounds, half kegs of about 175 pounds and quarter kegs of about 75 pounds, the number of the emery being determined by the mesh or number of holes in the cloth to the square inch. The principal numbers are as follows: 6, 8, 10, 12, 16, 21, 30, 36, 40, 46, 54, 60, 70, 80, 90, 100, 120, 140, 150, 160, 180, F, FF, FFF, FFFF. The first eleven numbers are what are termed "coarse grain," the second nine are the "fine grain" and the last four are "flours." In addition to these there are still finer flours. These are especially fine and used principally in optical work.

About 50 per cent of all emery is washed with water and then "blown" with a blower to remove the micaceous associates and other foreign matter. Emery so treated of course costs more to produce, but this treatment results in a pure article—one which will cut more keenly and be more durable than otherwise.

Much improvement has taken place in the manufacture of emery in recent years, the principal innovation being the "concentrating" machine, through the use of which the emery is "mulled." This process also removes the micaceous associates and relieves the emery of low grade ore.

The consumption of emery in this country for both grinding wheels and polishing purposes, in 1909 was about 9,000 short tons or 18,000,000 pounds.

Emery is a commodity in the manufacturing world which is absolutely indispensable and the use of it is constantly increasing. There is no material for polishing purposes which could be successfully substituted for the reason that it is peculiarly fitted for this work. For polishing purposes corundum is too hard; on the other hand garnet, quartz, and flint are entirely unfitted—they lack that physical property of toughness which is possessed to a marked degree by emery.

It is stated in the Electrical World that of the 5,000,000 horse power actually represented by the Niagara Falls, only about 5.5 per cent, or about 270,000 horse power, has been thus far utilized. Of this, 126,000 horse-power is employed in electrochemical processes, 56,000 horse-power for railway service, 36,400 horse-power for lighting, and 45,500 horse-power for various industrial services. Nearly 125,000 horse-power is transmitted to points more than ten miles from the falls. Of this amount 12,300 horse-power is transmitted over a distance of more than 100 miles, while 33,500 horse power is transmitted between 75 and 100 miles.